



Introducing public participation to energy planning

- Breaking with old traditions

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Abstract

Energy planning in municipalities has never had the traditions of including citizens even though it is highly used in other forms of planning. This paper investigates energy planning in Guldborgsund Municipality to see what it will bring to energy planning if heat consumers are including in the planning process and how this should be conducted. By using individual oil boilers and the process of phasing them out as a case, results from interviews with energy planners and heat consumers show how the municipality believes heat consumers do not want to be included in energy planning even though the opposite is said by heat consumers. It also highlights that including heat consumers can accelerate the change to more sustainable options of heat supply. This calls for municipalities to include heat consumers in energy planning by evolving the energy planner's role to become a hybrid energy planner who changes between different roles in different scenarios. This can be supported by changing the legislation for heat supply to also include planning for individual heating.

Pre-face

After three years on the Bachelor of Urban, Energy and Environmental Planning and two years on the master of Sustainable Cities in Aalborg University, Copenhagen, it all ends with this master thesis.

Through my education, there has been a huge focus on the sociological element in planning and how to include citizens. In combination with a more technical approach in my one year's internship in Rambøll's Energy planning division, I have tried to combine these two sides in this thesis. Furthermore, a contact to Guldborgsund Municipality was already established before starting this paper, and with the current issue of oil boilers, it seemed to be a good match. Hopefully, this paper will help municipalities re-think energy planning to not be solely technical but also consider citizens' perspectives, and that I can help Rambøll take the lead in this transition and show its many benefits.

I will like to direct a thank you to my supervisor, Louise Krog Jensen, who has guided me through this thesis, even though external circumstances made sure of we never met in person. I will also say thank you to my colleagues in Rambøll who have inspired me through their work and helped me with questions. Last, a huge thanks to Svend Allan Pedersen from Guldborgsund Municipality and the seven heat consumers to let me interview them.

Happy reading!

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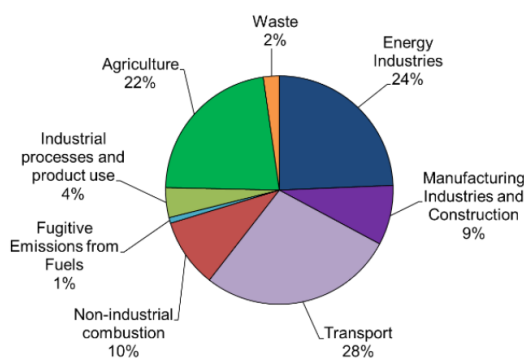
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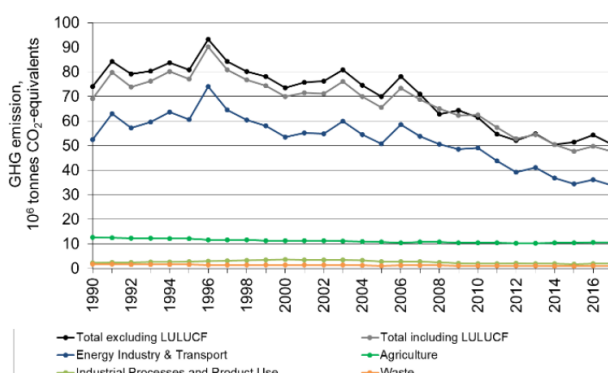
1. Problem analysis

1.1 The green transition in the Danish energy sector

In the fight against global warming and climate change, Denmark has decided in an energy agreement from 2018 to work towards net-zero emission of greenhouse gasses (GHG) in 2050 in accordance with the Paris Agreement (Klima-, Energi- og Forsyningsministeriet, N/A). According to Denmark's national inventory report, in 2017, Denmark emitted 50.6 million tons CO₂-equivalent which is a 31.9 % reduction from 1990 (DCE, 2019). Therefore, much work still has to be done before a net-zero emission goal will be achieved. This is even more important since the Danish government introduced a sub-goal for 2030 to reduce 70 % of all emissions (Regeringen, 2019). As seen for the recent years in Graph 2 below, the total emission in Denmark does not decrease as much as it has done in the years prior. In Graph 1, the distribution of CO₂-emissions in the different sectors shows how transport, energy, and agriculture are the biggest polluting sectors and it is here the biggest change must happen if Denmark must decrease CO₂-emissions drastically.



Graph 1: GHG emissions distributed for each sector in 2017 (DCE, 2019)



Graph 2: Trend of GHG emissions from 1990 to 2017 (DCE, 2019)

In line with a national target of being CO₂-neutral, Denmark has the ambition to be independent of fossil fuels like coal, oil, and gas in 2050. This includes that Denmark must instead produce energy with renewable energy sources (RES) like wind, solar, biomass, and geothermal energy. According to the Danish Energy Agency, the two most important strategies to achieve this national goal are by increasing the amount of the mentioned RES in the energy system and to ensure energy efficiency improvements. (Energistyrelsen a, N/A) This can prove to be difficult as fossil fuels are easier to store than energy from RES and energy from RES is a fluctuating energy source (see Chapter 5.1).

To help to reach the overall objectives, goals to phase out individual oil boilers and coal in energy production completely have been made. In 2030, coal must be out-phased, which is most often used

in power plants for collective heat and electricity production. It is a goal too that Individual oil boilers must be phased out in 2030 (Klima-, Energi- og Bygningsministeriet, 2020) which most often are found in houses outside the collective heat supply areas. From 1990 to 2017, coal consumption has decreased by 74 % as coal is being replaced with biomass (Klima-, Energi- og Forsyningsministeriet, 2018). This trend seems to continue in the future years, but this is not the case for individual oil boilers. Today there are between 70.000 and 100.000 oil boilers installed in houses and buildings for individual heat production (Jensen & Christensen, 2019), and if the current trend from the previous years continues, 10.000 to 20.000 houses will still have individual oil boilers installed in their home in 2030 (Rysgaard, Knudsen & Bramsen, 2019). This is calculated by *Denmarks Radio* (DR) based on the Danish Energy Agency's baseline projection for energy and assessed by Poul Erik Morthorst who is a member of *Klimarådet*.

1.2 Phasing out individual oil boilers

The reasons for phasing out individual oil boilers are many. First of all, they are expensive for users. This both applies the price of oil as a fuel and the maintenance of the boiler. This is often in combination with that oil boilers are placed in old buildings and homes that are poorly isolated and therefore run more inefficient and consume much more oil than needed. The third important reason for phasing out oil boilers is because of CO₂-emissions from burning the oil. (Lindegaard & Blomsterberg, 2016; Energistyrelsen, 2019) With the national target set by the Danish government, oil boilers used for heat supply should only belong to the past.

To help to phase out the rest of the individual oil boilers, the changing Danish governments have utilized different methods to help this process. In 2017, the former government decided to lower the tax for electricity used for heating starting in 2019. The tax decreases from 40.5 øre to 30.5 øre per kWh. From 2021 the tax will decrease further to 15.5 øre per kWh (Skatteministeriet, 2018). This initiative is meant to promote heat pumps that use electricity as fuel and can be a possible substitute for oil boilers. In theory, electric radiators can be used as well as long as the house is located outside of a district heating- or natural gas zone (Energistyrelsen, 1998), however, this is an expensive way to heat a house and is mostly used in buildings without a water-driven heat system (Frederiksen & Nenadovic, 2016). It is also possible to get a subsidy, energy-saving contribution (energispæredrag), for changing from an individual oil boiler to a more sustainable source of heat supply. However, this scheme ends at the end of 2020 (SparEnergi, 2019). In new buildings, it has since 2013 not been allowed to install an oil boiler, and in current houses with an option to connect to district heating or

natural gas, It has from 2016 not been allowed to replace a current heat supply system with a new oil boiler (Lindegård & Blomsterberg, 2016).

Some municipalities also take matters into their own hands. An example is Hjørring Municipality in Northern Jutland who in 2018 tried to phase out oil boilers by including oil boiler owners in co-creation to find more sustainable sources of heat production (Jensen, 2020). Hjørring Municipality had the objective to include the citizens as early as possible and accommodate the barriers for not changing. Through their work, Hjørring Municipality ended up creating 5 steps, as an approach to future planning where co-creation is in focus (SGO, N/A).

1. Clarify - where the problem's extent was clarified, and a strategy was made.
2. Investigate - where stakeholders were interviewed, and reasons were found for why oil boiler owners wanted or did not want to change heat supply.
3. Plan - in co-creation with citizens in workshops, different solutions were found.
4. Implement - the different solutions were used to phase out oil boilers.
5. Evaluate – The results were evaluated and what to do forward.

These five steps can also be compared to do the Plan-Do-Check-Act approach, which benefits from a circular planning approach as well (Bushell, 1992).

Through this strategy, Hjørring Municipality helped some heat consumers phase out their oil boilers. However, the municipality found it difficult to use co-creation in this specific case, as oil boilers are owned individually by citizens, and they cannot be forced to invest in a new form of heat supply (Jensen, 2020). Another problem Hjørring Municipality faced was the missing involvement of the heat consumers in the co-creation process. Thomas Jensen from Hjørring Municipality explains:

“We invited to this kind of a public meeting as well, where they (Red. citizens), even though we had written that it was about hearing from them and their experiences and their realities, then they still believed that they should sit down and we (Red. the municipality) should tell them. So it is something both we and citizens have to get used to in this type of cooperation.” (Jensen, 2020; 11:50) [Own translation]

The heat consumers were positive and attended the meeting, but they expected that the initiative was taken by the municipality which was not Hjørring Municipality's purpose. In the evaluation phase, it could be difficult as well to estimate if the municipality's initiative was the reason for some people replacing their old boiler for another type of heat supply, or if the change just happened naturally. (Jensen, 2020)

1.3 Which actors to analyze

Even though different initiatives have been taken by the government and in municipalities, there is still a long way to go before all individual oil boilers are replaced with more sustainable options of heat supply. Today, there are different alternatives for heating as district heating, individual boilers that run on biofuels or gas, different types of individual heat pumps, or a local district heating network. However, it is not possible to force people to change heat supply, and waiting for oil boilers to break down and be replaced naturally to another alternative might take too long if national targets must be met. To ensure a green transition away from individual oil boilers, it will be necessary to analyze different stakeholders to find out how this process can be accelerated.

With inspiration from Hjørring Municipality, the stakeholders that are included in the process of changing from individual oil boilers to more sustainable alternatives are

- heat consumers,
- public agencies,
- utility companies and service engineers,
- and energy specialists/experts.

Heat consumers are properly the most important actor to examine since they are the ones with the final saying and decision of which form of heat supply they want. Heat consumers' position might change from person to person as people weigh different values, have different income/economy, have different available alternatives to their current heat supply, knowledge, interest, etc. Therefore, examining only one heat consumers will not create a legitimate picture of the case. Instead, multiple different heat consumers must be interviewed which can give a better understanding of oil boiler owners' motivations and barriers to transit to another form of heat supply (see Chapter 7.).

Public agencies can be split into two, the government and the municipalities. The previous and current governments have set goals for reducing CO₂-emissions, energy consumption, and phasing out oil boilers (see Chapter 1.2). Their position in the process of out-phasing oil boilers is already known but this is not the case for each municipality. Today, there are 98 municipalities that each have their own agenda for reducing CO₂-emissions, energy consumption, and maybe oil boilers too to help to reach the national targets. Municipalities are also a step closer to the public than the government and have the option to influence heat consumers in their municipality with strategies, goals, plans, and politics.

Utility companies and service engineers are the parties who supply the heat consumer with district heating and natural gas or install and maintain boilers and heat pumps. Both have an interest in selling

their product and service, but utility companies are also governed by different regulations as they are obligated to be self-contained (see Chapter 5.2.4).

The last relevant stakeholder to include is *consultancy companies* who know which alternative solutions are best for the heat consumers economically and environmentally, but also for the whole energy system. These have possible already expertise from other municipalities with phasing out oil boilers and can help both municipalities to meet their energy demand and heat consumers by presenting different solutions.

1.4 Location of oil boilers

To clarify where in Denmark the problem is the biggest, results from a report of numbers and placements of types of individual heat supply in Denmark are used, made by the National Center of Environment and Energy (DCE, 2018). With data from chimney sweepers and the Building and Dwelling Register (BBR), oil boilers have been mapped to show where they are most common. In this mapping, Guldborgsund Municipality is one of the municipalities with the highest number of individual oil boilers (Figure 1). But when the density of oil boilers per km² and 1,000 inhabitants is portrayed, the numbers of oil boilers are very low (Figures 2 & 3).

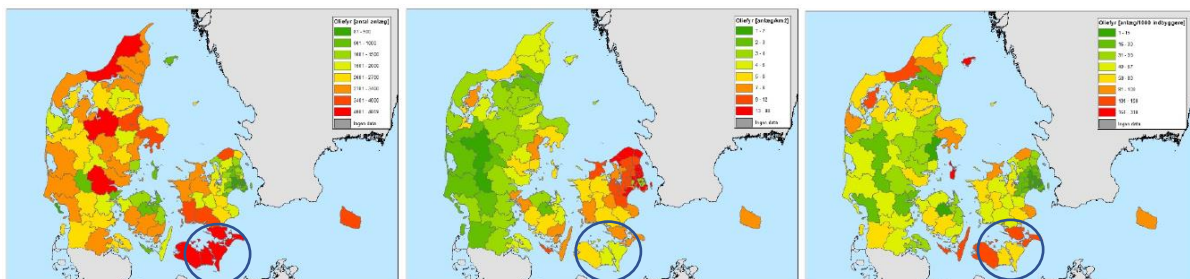


Figure 1: Number of individual oil-boilers in Denmark (DCE, 2018)

Figure 2: Number of individual oil-boilers per km² (DCE,2018)

Figure 3: Number of individual oil-boilers per 1000 inhabitants (DCE, 2018)

This indicates that Guldborgsund Municipality is a geographical big municipality, and inhabitants are living far enough from each other that collective heat supply might not be an option. Other municipalities with a higher density of people have better opportunities to phase out oil boilers with collective heating. This is not the case in Guldborgsund Municipality and many inhabitants have clearly kept their oil boilers.

If taking a closer look at Guldborgsund Municipality, individual oil boilers are spread all around the municipality (red dots). On the map below (Figure 4), electric heating is also shown in the light blue

dots, but from the BBR-data it is not possible to presume if they are either electric radiators or heat pumps.

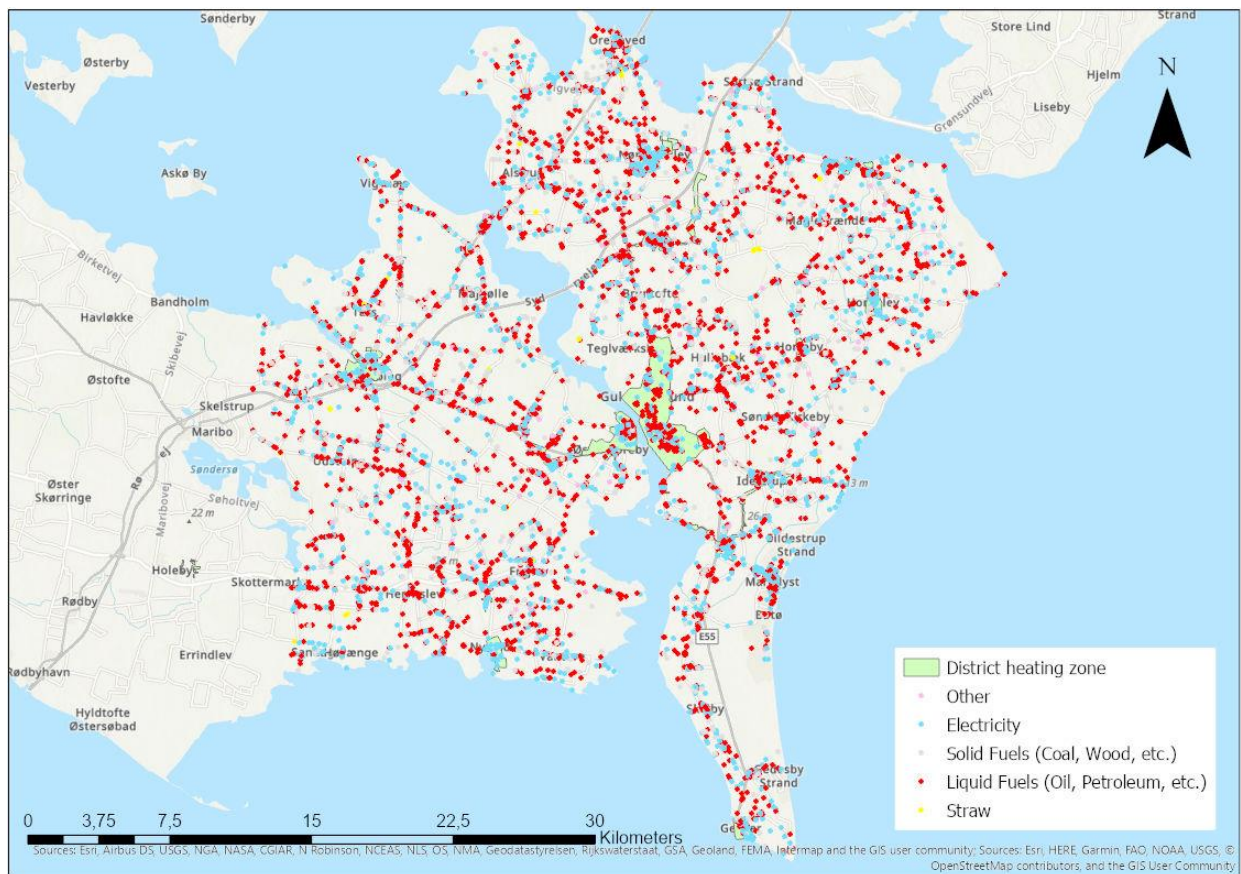


Figure 4: Map of individual heat supplies and district heating zones in Guldborgsund Municipality with data from BBR (Own illustration).

According to data from BBR, 6.866 buildings are supplied by oil, but the map only includes 732 buildings that use liquid fuel (oil). Data from BBR both include houses, sheds, carports, institutions, and every other type of buildings. This is taken into account and one-family house, multi-family house, terrace houses, and apartments are only included in Figure 4. Other types of buildings could be included in the figure, however, this will not change the picture of oil boilers are located all around the municipality. The data used from BBR might not be 100 % correct either. If a building changes to a different form of heat supply, the owner of the building must register the change themselves in BBR. This might not happen every time, and some buildings that are registered as being heated by oil might have another form of heat supply.

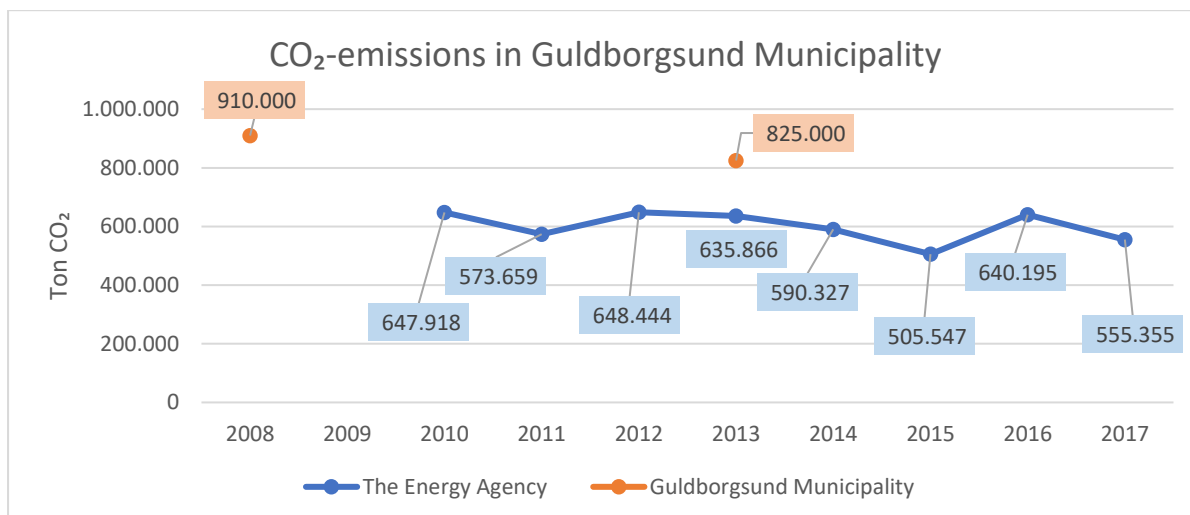
As seen in Figure 4, there are no specific hot spots or “islands” of individual oil boilers. Instead, it can be a problem with the high number of individual oil boilers and that they are placed all around the municipality. With the limited area that is categorized as a district heating zone (green polygons), not

many options for collective heating are available to make sure heat consumers cannot change to a new oil boiler in the future. However, some oil boilers are located inside these zones and it is only a question of time before these are phased out, if not it is because they have not changed registration yet. Furthermore, it is important to notice that there is no zone for natural gas, as natural gas has never reached Falster (see Chapter 5.2.1).

1.5 Guldborgsund Municipality's plan for heat supply

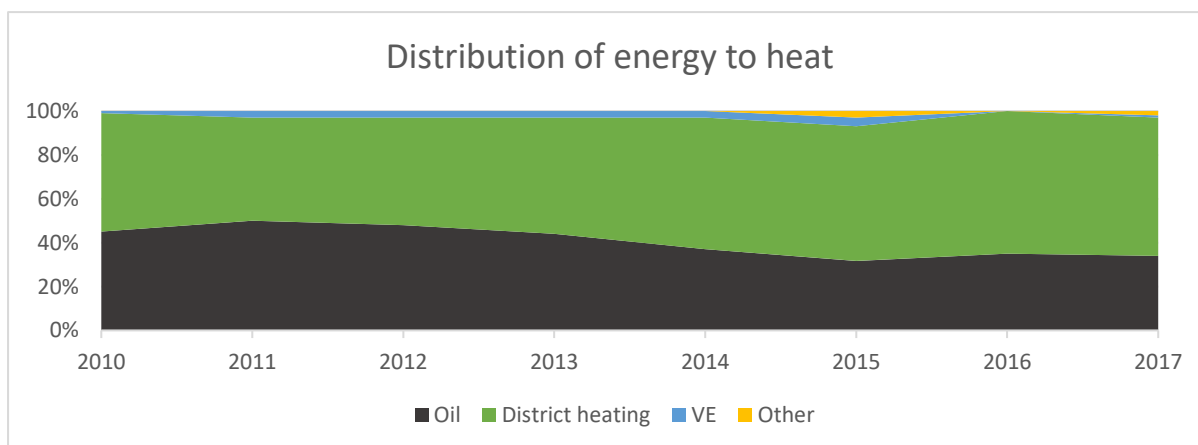
In 2011, Guldborgsund Municipality published its plan for heat supply from 2010 (Guldborgsund Municipality, 2011). This plan was made in the wake of the amalgam of municipalities in 2007, as Guldborgsund Municipality became merged by the former municipalities of Nykøbing Falster, Nysted, Nørre Alslev, Sakskøbing, Stubbekøbing, and Sydfalster. The objective of the plan was to explain the status of the collective heat supply in the Guldborgsund Municipality and to show the future potentials. Therefore, it did not include anything about individual heat supply and how to phase out oil boilers. However, today Guldborgsund Municipality is in its preliminary phase of creating a heat supply plan for 2020, and they have signed a contract with Rambøll to conduct this assignment (Pedersen, 2020). Furthermore, Guldborgsund Municipality has a goal to reduce the CO₂-emission from inhabitants with 20 % in 2020 and 30 % in 2030 compared to 2008. These climate goals were carried on from 2008 and are according to Svend Pedersen, an energy planner in Guldborgsund Municipality, not that ambitious because they are a rural municipality and do not have the same options to reduce CO₂ emissions with collective heat supply and public transport as done in city municipalities like Copenhagen (Pedersen, 2020).

Guldborgsund Municipality has in 2008 and 2013 made its own CO₂-calculation. However, they have not made one since. If their results are being compared to the Danish Energy Agency's calculations that run from 2010 to 2017, there is an approximately 200,000 tons difference in the amount of emitted CO₂ in 2013 (Graph 3). Using Guldborgsund Municipality's calculations, it is difficult to compare the development as they have only done two calculations and the latest was made seven years ago. Instead, by comparing the earliest numbers from the Energy Agency from 2010 to the most recent published in 2017, Guldborgsund Municipality has reduced its CO₂-emissions with 92,563 tons corresponding to a 14 % reduction (Graph 3). However, it can be difficult to compare Guldborgsund Municipality's numbers from 2008 with the Energy Agency's to see, if they are reaching their goals of CO₂-reduction as they have been calculated differently.

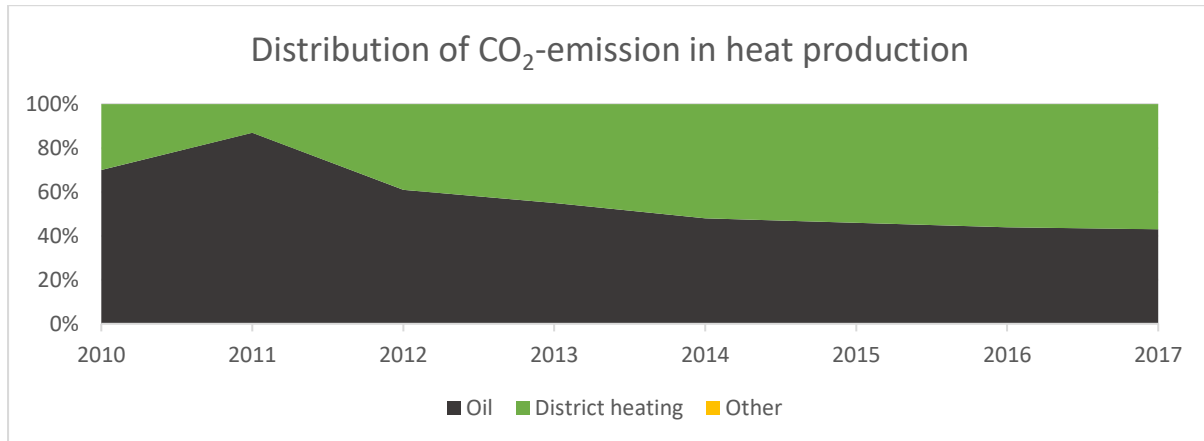


Graph 3: Calculations from the Danish Energy Agency (blue) and Guldborgsund Municipality (Orange) of the total CO₂-emission in Guldborgsund Municipality (Energistyrelsen b, N/A; Guldborgsund Municipality, 2014).

These results indicate that Guldborgsund Municipality has to do something to continue this trend to meet the targets of 20 % and 30 % reduction. Looking into the different types of energy consumption and their CO₂-emission, individual oil boilers contributes to the second-biggest share of both (Graph 4 & 5). Still, it has to be pointed out that the Energy Agency does not include electricity for heating. In Guldborgsund Municipality's plan for heat supply from 2011, it says approximal 29 % of the buildings are heated with oil and 13 % was heated with electricity (Guldborgsund Municipality, 2011). This is in correspondents with Graph 4 below, if 13 % of electricity was incorporated in the data and the ratio between oil and district heating is the same.



Graph 4: Distribution of energy sources used for heating in Guldborgsund Municipality (Energistyrelsen b, N/A)



Graph 5: Distribution of CO₂ emitted for each energy source in Guldborgsund Municipality (Energistyrelsen b, N/A)

Even though the energy consumption and CO₂-emissions have decreased from 2010, individual oil boilers still represent a huge share of the heat produced in Guldborgsund Municipality, and there is no sign of all oil boilers are being phased out before 2030. The only tool used today by Guldborgsund Municipality to phase out oil boilers is the plan for heat supply back from 2010. In this plan, which is most of all an outdated status report, it is highlighted that buildings that are supplied by oil boilers must be connected to the district heating network if they are located within or close to the district heating zones (Guldborgsund Municipality, 2011). As could be seen in Figure 4, the district heating zones do not cover much of the municipality and many of the oil supplied houses are also located outside of these zones. As well tells Svend Pedersen (2020) from Guldborgsund Municipality that they have chosen to let the transition of oil boilers being replaced with other types of heat supply happen naturally (see Chapter 6.1.1).

2. Research question

Denmark has several national targets to be both more energy-efficient, to reduce CO₂-emissions with 70 % in 2030, and being emitting net-zero in 2050. However, the decrease of CO₂-emissions has slowed down the last couple of years and new initiatives must be made. Especially in the energy sector that is one of the three biggest contributors to polluting alongside the transport and agriculture sectors. To accommodate this issue, the Danish Government has a goal that all individual oil boilers are being phased out before 2030, however, today this transition happens way too slow. The changing government has tried to make it appealing with different economic beneficial initiatives for oil boiler owners, and in Hjørring Municipality they have tried to phase out oil boilers in co-creation with heat consumers. Even though some changed their oil boiler to another form of heat supply, this strategy with including citizens did not go as well as wished for, and maybe they should have used public participation in another form? In Guldborgsund Municipality, they have a big issue with many houses supplied with individual oil boilers, but today they address this problem by just letting the transition happen naturally. Is this enough and is Denmark capable of reducing its CO₂-emissions with this approach? In the case of Guldborgsund Municipality and how to include citizens in energy planning to reduce CO₂-emissions, the research question with related sub-questions is stated below:

“What are the benefits and challenges to include heat consumers in energy planning, and how can the municipality use it to transit away from oil boilers into other sustainable options of heat supply?”

Sub-questions:

1. *What are the roles of the different stakeholders when municipalities plan for energy in today's Smart Energy System?*
2. *How do stakeholders' roles differ from general energy planning when planning for phasing out oil boilers?*
3. *How do heat consumers want to be included in the transition to other forms of heat supply?*
4. *In what way can public participation help oil boiler owners change their heat supply?*

3. Methodology

This chapter will describe the methods used in this research. It will be described what each used method can offer and how they are used in the study. The methods in this research have been qualitative with a focus upon interviews, but this chapter will also describe how the project is structured, the research design, and the used approach of data collection.

3.1 Reader's guide

This report consists of a problem analysis, the research question, methodology, theoretical approach, three analysis, a discussion, and in the end a conclusion. The problem analysis and research question are there to set the frame of this report and point out the problem which is supposed to be solved through this research. In this case, it is how to transit away from individual oil boilers by including heat consumers in energy planning. The structure and used methods and theories can be seen in the table below and will be conducted through a case study with Guldborgsund Municipality as the case.

	Analysis 1	Analysis 2	Analysis 3	Discussion
Methodology	Interviews	Interviews	Interviews	Findings from analyses
	Desk research	Desk research	-	
Theory	Role of planner	Role of planner	-	Role of planner
	Public participation	Public participation	Public participation	Public participation
	-	-	-	Radical technology change

Table 1: An overview of which methods and theories are used in each chapter

The first analysis revolves around the energy system and how the energy planner sees the roles of different stakeholders in today's energy planning. The second analysis dives into the roles of stakeholders when it comes to phasing out oil boilers. This is again analyzed from the energy planner's point of view as it is a part of their daily work. Analysis 3 looks at the subject from the heat consumers' point of view and how they want to be included in energy planning. This leads to the discussion which holds the findings up to each other to help discuss what solutions can be variable and how roles might need to change if individual oil boilers should be phased out.

As seen in Table 1, different methodological approaches and theories are used in each chapter. The used methods will be described in this chapter. The method of interview is in Analysis 1 and 2 conducted as expert interviews to get an understanding of how energy planning is structured in today's municipality. The interviews conducted for Analysis 3 are made as subject interviews where heat consumers' life-worlds are investigated. This allows seeing the same case from different angles. The method of desk research that is used in Analysis 1 and 2 builds upon what does the legislation says about energy planning in municipalities, and what roles it lay upon the energy planner. Furthermore, it has been used in the problem analysis to work towards the research question.

The theoretical framework consists of three theories; role of the planner, public participation in urban planning, and radical technology change. The theory of the planner's role is included in the two first analyses to see what type of energy planner role is used today in a municipality and will in the discussion be used to figure out if the role should change. The theory of public participation is used in all three analyses as to how the municipality is including heat consumers in energy planning today, and in the third analysis as to how heat consumers want to be included in public participation. The benefits and consequences of this methodical approach will be held up against the findings from the three analyses of how energy planners should include heat consumers in future public participation processes. The third theory of radical technology change will mostly be an underlying factor of what happens when changing technology and will be used in the discussion to show how some of the dimensions explained in the theory might have to change.

3.2 Research design: A case study

The research design used in this study will be conducted through a case study. A case study is by Robert Yin (2012; p. 4) described as a research method where the researcher goes into depth in one or few cases in a real-world context to get a deep understanding of the subject and provide new knowledge. With specific knowledge from a single case, Bent Flyvbjerg (2006) advocates that a case study's specific knowledge can be generalized to other cases as well. In earlier years, conventional views on case studies believed case studies could only be used in inductive research where observations are made for in the end to develop a theory or a set of rules. Again, this view is by Bent Flyvbjerg (2006) rejected, and he believes case studies can be used in deductive research as well. Therefore, a research design can use general knowledge through compelling theories and test them by analyzing data for in the end being able to some extent reject or confirm the theory.

This research is a deductive research using Guldborgsund Municipality as a case in a case study. This municipality is chosen because of the high number of installed individual oil boilers, its low density of population, and because of an already established contact between the municipality and Rambøll. Guldborgsund Municipality can then be used to illustrate how public participation can be used to phase out oil boilers, for in the end to see to what extent public participation can be utilized in energy planning in other scenarios than phasing out oil boilers.

3.3 Data collection

In the book *Social Research Design* by Alan Bryman (2012), he describes qualitative methods to be focusing on words instead of collecting quantitative and measurable data. Of the different qualitative methods, interviews are the most common type of qualitative method, as it can be flexible in collecting data (Bryman, 2012; p. 469-470). The purpose of using interviews in this research has been to get an understanding of the different stakeholder's points of view on individual oil boilers and the inclusion of heat consumers in energy planning. This makes qualitative interviews a good method of choice, as it emphasizes on subject matters' insight in their lifeworld and can go into a subject much deeper than any quantitative methods (Bryman, 2012; p. 470).

This research uses both semi-structured expert interviews with energy planners and semi-structured subject interviews with heat consumers. Semi-structured interviews are a common qualitative method where before the interview is prepared themes and corresponding questions. A strategy has been made to gather as much relevant knowledge as possible. However, the interviewed person can give answers which also answer later questions, and as the interviewer, a new order of questions might be made under the interview. This is opposite to the structured interview, where the order of the question is important and does not leave any freedom to the interviewed person to go off on a tangent as their answers must be completely comparable like a survey (Bryman, 2012; p. 470). This is not wished for in this research, as it closes for further knowledge which could be interesting for the case.

Even though both interviews with energy planners and heat consumers were semi-structured, the interviews with the heat consumers were a little more structured. This was because of the different objectives with the two forms of interviews, and what time in the process they were conducted. When interviewing energy planners it was at the start of the research process and the main purpose was to obtain as much knowledge as possible to later filter that knowledge out that will be useful for this rapport. Therefore, it sometimes became more of a conversation where ideas and thoughts were turned with the interviewees. Still, themes and questions were made to make sure the interviews were kept relevant (see Appendix 4 and 7 for interview guides). The structure of the interviews with

heat consumers was more stringent as they were interviewed for a more specific purpose, and because there had to be held multiple of them which took a lot of time. It was not structured interviews but the theme of their type of heat supply was discussed before going to the next theme of public participation (see Appendix 8 for question guide). However, it can be difficult to stick to an agenda, as people often have a lot on their heart when describing their life world. Therefore, it was about keeping the interview on track to make sure it kept being relevant, for in the end allowing the heat consumer to express any other issues or points which they found important. If it was chosen to use structured interviews instead, the same questions will have been asked for each heat consumer, and it would have been possible to more easily compare their statements if it was wanted. However, this semi-structured approach made it possible to obtain the wanted knowledge but also to be open for new points as well, as each heat consumer's situation was different.

There are also risks when using semi-structured interviews. When interviewing someone, they have the right to express themselves as they wish. This can result in them trying to support their actions and why they are thinking or acting as they are. Therefore, they can withhold information too, as it might not support their case. This is especially relevant in this research as the same case has been investigated from both the energy planners' and heat consumers' points of view to see if there are any contradictions. It is then up to the interviewer to either challenge the interviewed person or to see if there are conflicting statements across interviews, as it can be useful in the analysis to understand why they answer as they do. With interviews, the results can be different depending on which energy planners and heat consumers are interviewed. Therefore, it is necessary to have enough interviews to make sure certain trends are showing and to saturate a subject. A method to get an even better understanding of certain patterns and trends could be through a quantitative survey, and the use of this will be discussed in Chapter 8.3.

All interviews were held over the phone except one which was conducted through email correspondence. Even though there is no evidence for answers being different between interviews being held face-to-face or over the phone (Bryman, 2012; p. 488), it was never the plan to conduct the interviews over the phone. As an interviewer, it is easier to conduct an interview when sitting across for the interviewed person, as it is possible to show understanding without saying small words as *yeah*, *okay*, and, *mm hm*, which can interrupt the interviewed person in their speech. Just as well, when not being able to see each other, it can be difficult to see if one still has something to say and is just thinking over the answer. Again, this can result in them being interrupted, and therefore, it has been very important to give the interviewed person time to finish their answer. It was never the plan from the beginning to interview over the phone, but unfortunate external circumstances in the form

of Covid-19 made this necessary. The last person who was not interviewed over the phone was the energy planner from Rambøll. He was more comfortable getting questions sent and answering them in an email. In this case, it was still possible to ask additional questions to his statements. Even though the interview approach became different than expected, the quality of data collected was still satisfying.

3.3.1 Expert interviews

The three expert interviews were held with professional energy planners who daily work with energy planning in different municipalities or professions. This was done to get an inside in how they work with energy planning, phasing out oil boilers, and how they previously have included citizens in their work. The first initial interview was held with an energy planner from a municipality who previously had included citizens in phasing out individual oil boilers. With knowledge about what options a municipality can have in this process, it was then possible to make questions for the case municipality that both challenge their approach of phasing out oil boilers and to get a better understanding of why they are acting as they do. To get an external point of view on the case, an energy planner from Rambøll was interviewed. Their knowledge could be used in the interviews with the heat consumers too. All interviews were recorded and transcribed to more easily analyze their statements and find quotes for the analyses. The three expert interviews are presented in the next sections.

Thomas Jensen, Hjørring Municipality

The first interview was held with Thomas Jensen from Hjørring Municipality who has been managing a project about finding a method for co-creating in the green transition. This was an initial interview that should help create knowledge about the case of public participation in energy planning and the planning done to phase out oil boilers before going into the actual case of Guldborgsund Municipality. The purpose of the interview was then to get answered the three themes. The first was about the overall strategy of energy planning and phasing out oil boiler in Hjørring Municipality. Next, it was to get a deeper understanding of their work with their method to use co-creation to phase out oil boilers. The last theme dealt with if heat consumers prior have been included in energy planning. (see Appendix 1 for the interview guide)

This interview answered the wanted themes and questions while giving a deeper insight into how Hjørring Municipality operates and what issues they faced in their work. Just as well it explained the problem of that it is heat consumers' choice if they want to phase out their oil boiler or not, and how this was a challenge when focusing on co-creation. (See Appendix 2 and 3 for the interview and the transcript)

Svend Allan Pedersen, Guldborgsund Municipality

The second interview was with Svend Allan Pedersen who has been employed in Guldborgsund Municipality since the municipality merge in 2007 and is working with energy and environmental planning. This interview was important to help answer the two first analyses, as it had the purpose of identifying the different stakeholders' role in energy planning and when phasing out individual oil boilers. To get this knowledge, the first theme that was talked about was Guldborgsund Municipality and its plans for heat supply. Next, questions were targeting the case of individual oil boilers in the municipality and what the municipality do to phase them out. The last theme concerned the use of public participation in energy planning and how much they have used it and how it worked out. (See Appendix 4 for the interview guide)

The interview with Svend Pedersen gave a great insight into the different elements as stated above. He also told about two projects where heat consumers wanted a local district heating plant, how the municipality helped in the process, and how the projects ended up not being established. Having Guldborgsund Municipality's point of view from Svend Pedersen, it was easier to prepare the questions for the heat consumers, as it gave knowledge about what kind of inclusion the heat consumers have been met with previously. (See Appendix 5 and 6 for the interview and the transcript)

Klaus Fafner, Rambøll

The last expert interview was with Klaus Fafner who has been a technical expert and energy planner in Rambøll in more than 30 years. With his work with municipalities, for example, Guldborgsund Municipality, he has a great external insight into how municipalities plan for phasing out oil boiler and how they create plans for heat supply. With his many years of experience, he also knows how the planning has changed through the years and which alternative options are the most common for oil boiler owners when they want to change their heat supply. (See Appendix 7 for the questions)

The email-interview answered the necessary questions as was asked, but it did not give any additional knowledge. This is the weakness of an interview being written as only the concrete questions will be answered. However, the interview gave sufficient answers to the subject and what solutions heat consumers most likely will look into. These solutions could then be discussed in the interviews with heat consumers. (See Appendix 7 for the answers)

3.3.2 Subject interviews

In this research, there have been conducted seven interviews with citizens in Guldborgsund Municipality who all are heat consumers with different types of heat supply (Table 2). Some of these heat consumers have an oil boiler today, some have changed away from oil boilers, while others have

heat pumps, pellet boilers, or district heating. There were two purposes for these interviews. The first purpose was to get an understanding of their heat supply. How they were looking at their form of heat supply, what factors were important for keeping or changing away from oil boilers, and what made them change or wait to change heat supply. The second purpose was to investigate how motivated they were to participate in public participation for phasing out oil boilers and if so how and when they wanted to be included in the process (see Appendix 8 for Interview guide). This insight was interesting to hear after talking with the municipalities to see if there were any contradictions.

To get the point of view from the heat consumers in Guldborgsund Municipality, seven interviews were conducted with people from six households. Six of the interviews were held with individual people, and the seventh interview was held with a couple from one household. The process of finding these people started by mapping every small town in Guldborgsund Municipality. A Wikipedia page named "*Byer i Guldborgsund Kommune*" (Towns in Guldborgsund Municipality) had a list of every town in the municipality which also has its own Wikipedia page (Wikipedia, 2018). This list counted 29 towns, even though there probably are other towns as well but without their own Wikipedia page. 21 of these towns were chosen because they have less than 1,000 citizens, as individual oil boilers are most common in towns in rural districts where district heating is not present. For each of the 21 towns, it was tried to find a local Facebook group. This was possible for 15 of the towns and some of the Facebook groups represented multiple towns or districts. By contacting the owners of these groups, they were asked if it was possible to post a request in their group asking if anybody has or has had an oil boiler, and is willing to be interviewed. This was possible in eight of the 15 groups. In some of these Facebook groups, the post got a few likes while in other the post gave no traction at all. This resulted in nobody volunteered. Instead, everybody who liked the post was contacted, as it could be a gesture for them wanting to participate but did not want to write it. This approach resulted in six interviews. The seventh and last interviewed person was with a woman suggested by her daughter.

Interviewed	Current heat supply	Previous heat supply
Frederik (Appendix 9 and 10)	District Heating	<i>Has not changed</i>
Merethe + Flemming (Appendix 11 and 12)	Wood pellet boiler	Oil boiler
Hanne (Appendix 13 and 14)	Air-to-water heat pump	Ice-stick heat pump (air-to-water)
	Electric heating	Electric heating
Ole (Appendix 15 and 16)	Air-to-air heat pumps	Electric heating
	Oil boiler	<i>Has not changed</i>
Niels (Appendix 17)	Oil boiler	<i>Has not changed</i>
Rie (Appendix 18 and 19)	Oil boiler	Oil boiler
Rico (Appendix 20 and 21)	Air-to-water heat pump	Oil boiler

Table 2: A summary of each interviewer's current and previous type of heat supply. Each interview's sound file and transcription can be found in the Appendix according to the table. In the interview with Niels, the sound file is lost and there only remains a summary of the interview.

Table 2 shows the current and previous types of heat supply. As can be seen, there is a big spread of the combinations of the current and previous types of heat supply between the heat consumers. This has both been negative and positive. The main purpose was to reach out to citizens who today have an oil boiler as a heat supply. This was only the case for three of the interviews and three have had an oil boiler previously. However, by interviewing people who have other types of heat supply, they can give insight into how it works for them, which issues they see with it, and if they still want to participate in public participation. This gives more points of view compared to everybody being in the same situation. Therefore, they have each brought each their knowledge to this study. For some of the interviewed persons, they even have multiple houses with different types of heat supply. This allowed them to compare the different types of heat supply.

4. Theoretical framework

This chapter will present the three theories used for creating this research's theoretical framework. These include the role of the planner, public participation, and radical technology change. These are chosen on behalf of a conducted litterateur study, explaining the few cases where citizens are included in energy planning today, and how this study will stand out to current research. Of the theories used in this research's theoretical framework, first, a review of how the role of the urban planner has changed through the years will be conducted to get an understanding of how urban planners in municipalities functions today, and if this can be translated to energy planners as well. This will help answer the two first sub-questions to the research question as to what is the energy planner's role in today's current energy planning and when phasing out oil boilers (See chapter 5.2.1 and 6.1.1). It will also be used in the discussion to find out if there is a need for another type of planner in energy planning (see Chapter 8.1). The next theory about public participation is used to get an understanding of what it can give to a planning process when including citizens but also what issues it brings. This is built upon the theory of the planner as this is the actor who includes citizens. The theory of public participation is used in three analyses and the discussion (see Chapter 5.2, 6.1, 7.2, and 8.2) as the focus of the research question is to investigate what it can give to energy planning to include heat consumers. However, the knowledge about public participation has mainly been used to conduct the interviews and help answer the third sub-question of how heat consumers want to be included. The third and final theory is radical technology change and is mainly used in the discussion to answer the fourth sub-question of how public participation can make oil boiler owners change their heat supply (see Chapter 8.). The knowledge from this theory will help to point out what dimensions in technology might need to change when citizens are involved in energy planning and if the role of the planner has to change. In this way, all theories are somewhat connected.

4.1 Litterateur study

Even though energy planning does not have a great tradition of using citizens (Wright, 2004), combining these two elements has been touched upon before. However, they have all had different approaches and intentions and this part will showcase how this research stands out and fills out a research gap that has not been examined before.

The greatest contributor to the research field of using or not using public participation in some form of energy planning is when establishing windmills. This has mainly been because of the opposition from the public to have windmills being established close to their home, also described by Patrick

Devine-Wright (2004) as NIMBY (not in my back yard). In his paper, *Beyond NIMBYism: towards an Integrated Framework for Understanding Public Perceptions of Wind Energy*, he reviews existing researches about how citizens have been included in the process when establishing new windmills and how the public has been scientifically researched. He concludes among other things that there is a need for “*more theoretically informed empirical research, grounded in social science concepts and methods*” (Wright, 2004). Even though his paper focusing on wind energy, the approach of using social science concepts in energy planning is what has been done in this study. Just as well, the paper gives an insight into what problems it can give if citizens are not included in the planning process when new energy supply is being built close to people's homes, even though they are pro-environment. This is where this research stands out compared to Wright's, as this research concentrates on individual heat supply and oil boilers as a case. Only in a few cases, a solution could be to establish a new or expand the collective heat network. Something that to some extent can be compared to establishing windmills. In those cases, there might be opposition towards a new district heating plant because of its location or because of the rising distrust of biomass being sustainable. Instead, most often individual oil boilers are substituted for other individual solutions like heat pumps or other types of boilers.

Someone who has already looked into including citizens in a co-creation process to phase out oil boilers in people's homes is Hjørring Municipality. They have with an inductive approach developed a method to co-create with citizens in the green transition by also using the high amount of oil boilers in their municipality as a case (Jensen, 2020). Hjørring Municipality's project has also focused on including citizens as early as possible, in contrast to this study which tests if it is best to include them as early as possible or to wait further in the process. Still, this work has been used to get an understanding of how a process could be when including heat consumers. However, this research stands out to Hjørring Municipality's work by using the opposite approach, a deductive approach, where theories and methods about including citizens are tested in the context of energy planning and getting people to phase out their oil boilers. This research will neither only focus on co-creation as a possibility to include heat consumers, as multiple levels of public participation are possible as explained in the chapter about Arnstein's ladder of participation (see Chapter 4.3.1).

4.2 Role of the planner

The role of the planner has changed over the years, but the importance of planning has retained its importance. With planning it is possible to set goals and targets in which direction we want to go in society. Even though different countries and areas have different political systems and stakeholders,

planning creates an overview of how politicians, the industry, and citizens should act and what is expected by the future (Newman & Thornley, 1996; p. 3-8).

Since the 1950s and 1960s, the autonomous planner influenced urban planning with a rational planning approach (Sehested, 2009; Cajot et. al, 2017). Functioning as a professional expert, the planner operated inside public bureaucracies and could monopolize the decisions because planners were known as knowing best. This was done with a very analytical approach by the planner first analyzing the problem, then setting goals, formulating actions, for in the end evaluating the results (Banfield & Meyerson, 1955). This type of planner was known as being able to find or possessing the big truth, and therefore, planners were the supreme decider and dictating the direction a city must be constructed to function most optimal. They were given this authority as experts because planners worked for what they believed was in the best interest of society (Lawrence, 2000). In this nature, the planner is characterized, as done by Sandercock (1998), by finding rational and objective knowledge which then becomes comprehensive rules. However, rational planners also have weaknesses. Because the planner is operating as the best knowledgeable, other stakeholders' opinions and interests are not taking into consideration. Very little public participation is incorporated in the planning process, and with a top-down planning process, planning is controlled by a very few people (Lawrence, 2000). Another negative element of rational planning is that today it is seen as being simplistic. Planning often happened in a static setting meaning that external variables were not included in the planning process (Albers, 1986).

As a critical response to rational planning, pragmatism became a planning theory, best implemented in incremental planning. Opposite rational planning, incrementalism focuses on negotiation between stakeholders and interest groups for them to agree. However, this form of planning has been known for the lack of setting long-term goals and instead to operate with an ad hoc approach. By working towards small and changeable milestones instead, the final long-term prospects can change through the process. By only reaching for small changes, it can be easier to succeed, especially when in pragmatic planning each planning situation is seen as being unique and there is no fixed formula. (Lawrence, 2000)

Another reaction to rational planning is socio-ecological idealism and political-economic mobilization. Where socio-ecological idealism strongly focuses on environmentalism and the relationship between humans, building structure, and nature, political-economic mobilization focuses on social injustice. This is especially known as advocacy planning where the planner functions as a social justice advocate because there is a different power relation between stakeholders. In this planning approach, the planner can end up becoming subjective to protect what the planner thinks is best needed for

stakeholders with the least power. With this idealistic approach, the objective is to redistribute resources from the elite to the ones with fewer resources. (Lawrence, 2000; Sehested, 2009)

Today, the planner has changed towards a collaborative approach with much more dialogue and communication between all stakeholders. Through such processes, the role of the planner is neither the independent expert nor one who takes special interest groups in defense. Instead, the planner is working towards a broad consensus as a mediator. As well is public participation in collaborative planning seen as an alternative to mainly including professional experts. It is the good discussion and negotiating that must form the solutions. (Lawrence, 2000) However, public participation can often be fractious, and finding solutions that meet everybody's interests can be difficult (Lawrence, 2000; Cajot et.al, 2017). Furthermore, authorities are known to fail involving the public over longer periods (Cajot et. al, 2017), and some still question how relevant it is to include citizens in complex and technical issues (Chilvers, 2008). Still, public participatory planning is known as increasing the wide acceptance from the public (Loring, 2007), and is reflected in Danish legislation where the act of planning states: "that the public is involved in the planning process to the greatest extent possible" (Erhvervsministeriet, 2018; §1 stk. 2) [Own translation].

Through the change of the urban planner's role and different planning paradigms, from being the expert knowing the big truth to today where a more dialog specified approach of planning is accepted in which citizens are included in the planning process, it still questions how the planner should function in energy planning. Is there a difference between this and urban planning, are citizens just an as big valuable resource, how should they be included, and what if energy planning is too abstract and technical a field to benefit from public participation?

4.3 Public participation

Public participation can be understood differently between planners, politicians, or citizens, and even those people might not have the same definitions as well. If there are different views on the understanding of participation, it can create an opposition between groups to the real target, in this case phasing out oil boilers. Therefore, it is important to have an understanding and a clear definition of the concept of public participation. This will be done based on Annika Agger and Birgitte Hoffmann's (2008) book, *Borgerne på banen* (citizens on the field).

As mentioned, public participation can be understood differently, but the words incline that some form of including citizens must be present. This implies that citizens and public stakeholders must in some form discuss a problem to work towards a common goal or solution. However, in this research, each oil boiler owner is a stakeholder in their own case. Even though multiple owners are in the same

situation, there is not necessary any community between the oil boiler owners and they can all take each their decision. This is opposite to more traditional participation as multiple citizens will join forces and end up with one solution. This difference is caused by individual oil boilers are located in people's private homes, and the owners are not dependent on their neighbors' choice or opinion. People are not responsible for their neighbors' choice of heating supply, still, participation between citizens can have a positive influence. The theory of public participation is mainly focused on citizens being multiple people (Agger & Hoffmann, 2008; Arnstein, 1969). Therefore, it is important to notice that in this research public participation can both be individual and for a community.

There are different reasons for why including citizens in planning is beneficial. First, citizens can become a valuable resource because they have specific knowledge about the specific case. This knowledge can be something planners do not have excess to, and can help decide if one solution is better than another. Bringing citizens into planning can also be a supplement to public authorities' resources. Citizens can take over some tasks which will save the public agency money and time. Citizen knows exactly where the problem is. It is their daily life that is being influenced and from this local knowledge, they might have competences to find the necessary solutions. As mentioned in the previous section, citizens' feeling of ownership of a project will increase if they are included in the planning process. If citizens are not included, a risk will be that they instead will become opponents of the project because they will feel decisions have been taken over their heads. In line with this, public participation can create a mutual learning process. Citizens get a better understanding of the public agency and the planning process, meanwhile, planners gain knowledge about the area, the people, and what issues can be solved in the future. (Agger & Hoffmann, 2008; p. 12-17)

So far in this chapter, public participant has been portrayed mainly positive. However, there are still challenges and issues with this concept. Conflicts among citizens or between citizens and planners are inevitable. Everybody has their own agenda, and when it is getting challenged by other's agendas, conflicts will emerge. In Denmark it has been a long tradition to focus upon consensus, however, this often only leads to small changes as new innovative solutions often meet opposition. Still, conflicts contribute discussions which can be good to understand each person's incentives. Some citizens already have experiences from earlier cooperation with the public agency, but if these projects ended in conflicts, those citizens will already be watchful from the start. A conflict can both be because of disagreements, but it can also be due to a protracted process. If a project takes too long, participants will drop out because they become frustrated and because they get drained of resources. It can also be a problem that it is not everybody who is participating. There are two reasons for citizens not participating; some do not care and some are excluded. Often, it is young people, families with young

children, ethnic minorities, people on the margins of society, and socioeconomically advantaged who are not participating. Either, they are too busy, they do not care, or they are excluded by the arena public participation is happening. Meetings can be in the time where parents are working or taking care of their children, language can be excluding to ethnic minorities, and groups of people can undermine other persons who then do not bother showing up. (Agger & Hoffmann, 2008; p. 19, 36-38)

With an idea of what makes public participation successful or a failure, it must be addressed when participation is seen as a success. Successful public participation can be defined differently depending on who is asked and what their role is. Often, a politician will see it as a success if many citizens are participating, the planner sees it as a success if new proposals and ideas are being found, and the citizens want to be included in the decision making and to see the change. It is not necessary to have a common definition of successful participation, but it must be kept in mind that different groups can see a participation process being a positive experience when others can find it the opposite. Also, it is important not only noticing concrete and visible outcomes. Public participation is also about creating something together as a united community and creating a good experience for all actors. (Agger & Hoffmann, 2008; p. 29-32)

4.3.1 Levels of public participation

Public participation is important in collaborative planning because of its benefits and democratically involves citizens in planning. However, public participation is not a singular method. The approach changes from case to case and to how much and how citizens are involved. This is explained by Sherry R. Arnstein (1969) as she explains the eight rungs on the ladder of citizen participation; manipulation, therapy, informing, consultation, placation, partnership, delegated power, and citizen control (Figure 5).

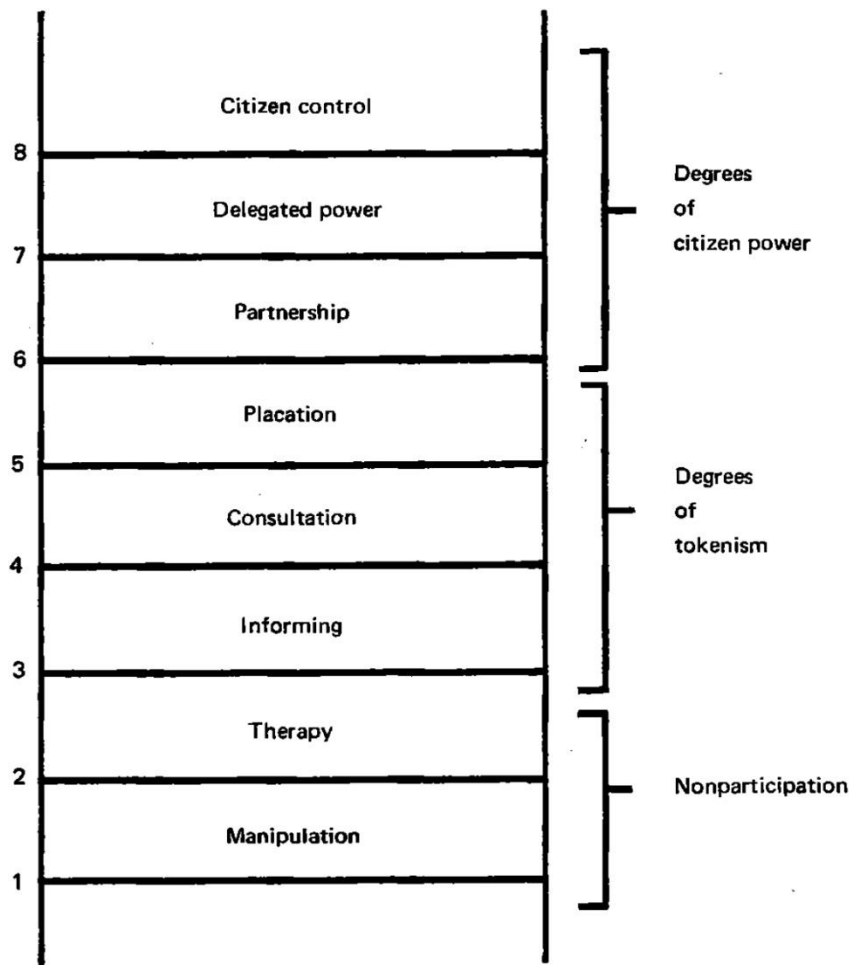


Figure 5: The eight rungs on the ladder of citizen participation (Arnstein, 1969).

Non-participation covers the two lowest rungs on the ladder; manipulation and therapy. This form of participation is not meant to include citizens in the process, but more to educate and change their minds. Manipulation, as the lowest rung, have little to none participation of citizens. citizens are placed in committee boards with the only purpose to educate them to support the powerholders' decisions. Participation becomes an illusion and citizens are manipulated by positive-worded terms that have no substances. The second rung, therapy, sometimes can be classified as the lowest rung as well. On this level, citizens are engaged in activities but with the focus of making them agree with the powerholders. It is also a way to make the citizens forget about other important matters in a community. (Arnstein, 1969)

The next two rungs fall within degrees of tokenism; informing and consultation. On these rungs, citizens might be heard and have the opportunity to hear about the process from the powerholders. However, it is not guaranteed that citizens' objections are taken into considering. Most often, including citizens only becomes a symbolic gesture. The third rung, informing, is the first real step

towards real participation as non-participation cannot be classified as genuine participation. The issue is that informing is only one-way communication. This is often done through news media, pamphlets, and emails with no option to respond. This provides a problem that citizens have no option to provide feedback. If informing is done through public meetings, the agenda can leave no time for questions, and irrelevant information and answers can be given to prevent citizens' involvement. The next step on the ladder is consultation. This time, citizens' opinions are invited for feedback and it becomes a two-way communication. This is often done by surveys, meetings, and public hearings. The issue with consultation is that the power holders do not have to act on the response. It mostly becomes a way to make people participate in participation. (Arnstein, 1969)

The fifth rung, placation, falls between tokenism and the next three ladders with degrees of citizen powers. Here, citizens are included in the process, but powerholders still have the final saying. Still, on this level citizens have more of a saying compared to the other levels, but still less than if they have substantial power. Placation can be used by placing representatives of citizens on the board with the powerholders. In this way, the representatives have an actual voice and a vote in the decision making. However, they will often have a minority of votes and can be outvoted. (Arnstein, 1969)

The last three rungs include degrees of citizen power; *partnership*, *delegated power*, and *citizen control*. On these steps, citizens can negotiate with the power holders, be in charge, and have the final saying in the planning process. On the sixth rung, *partnership*, the power and decisions are shared between powerholders and the citizens. It is done through negotiations and specific elements in a plan might be handed to the citizens. Still, some ground rules must be made as citizens can be overruled on the most essential decisions. The second-highest rung on the ladder is *delegated power*. Instead of sharing the power with the powerholders, citizens are achieving the dominant decision of a plan. Therefore, citizens are also becoming accountable for the result. Powerholders will still be necessary to bargain with citizens to make sure the process will go in the right direction and not start focusing on other areas instead. The highest rung on the ladder of public participation is *citizen control*. At this stage, no powerholders are included, and it is only citizens who run the program. A community, school, or similar institution will be community-controlled, and it is solely their decision on how they want to plan.

This theory often portrays powerholders negatively, and that public participation should solely strive for the highest rung possible. However, it could be possible that sometimes this should not be the case. If citizens always would have delegated power or full control, the theory of citizen involvement from Annika Agger and Birgitte Hoffman (2008) shows, that conflict could emerge when different citizens have different agendas. As well it is mentioned by Chilvers (2008) that something as energy

planning could be too complex for citizens and using resources on taking their inputs could be immaterial. It is also shown that not all groups of people care about participation (Agger & Hoffman, 2008). For some, maybe it will be enough just to gain information about what changes are about to come. Therefore, it is important not to see this theory as the higher you are on the ladder the better it is for public participation. Instead, it must be used to see what each level induces and entail to find out what rung, or rungs, can be most optimal in a specific case. At last, it must be noted that this theory is from 1969. Today, people on social media have a platform for when they are displeased. For instance, the rung of *informing* will end up as being a two-way communication instead as people can post comments on a organization's or municipality's Facebook page.

4.4 Radical technology change

A theoretical framework about phasing out individual oil boilers should not only include citizens' and planners' perspectives. The change in technology is also an important dimension to consider because it might not be easy to change from one technology used for heating to another. In the book, *Renewable Energy Systems* by Henrik Lund (2014), the theory about radical technology change is explained.

With inspiration from Bernd Möller (1984) and Frede Hvelplund (2005), technology is defined as a combination between the five principles; technique, knowledge, organization, products, and profit. Hvelplund (2005) then defines a radical change as when more than one of these dimensions change. If one dimension changes and the others stay the same, the changed dimension will go back to normal. This is because fundamental change can not happen without some other principles changes as well; they are in some way all connected.

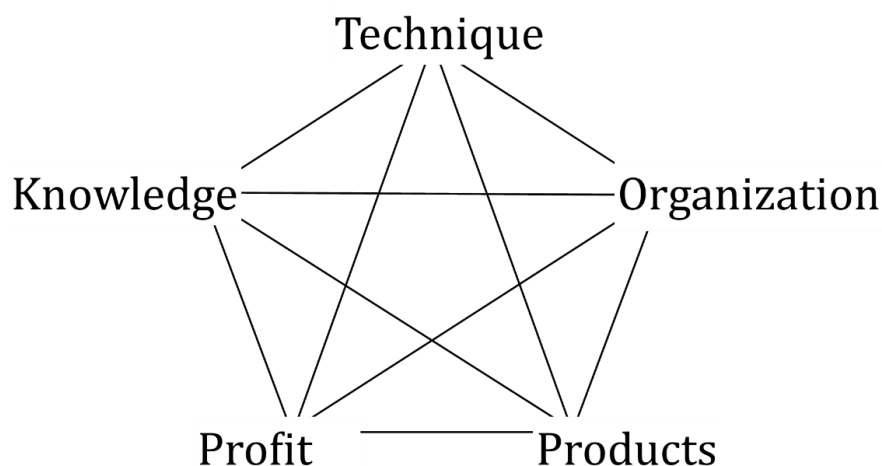


Figure 6: Illustration of how each dimension is connected to each other (Own illustration).

According to Lund (2014), changing to a renewable energy system is seen as a radical change because all of the different dimensions will need to change before it is possible. With this argumentation, this must be the case for phasing out individual oil boilers as well since other products must be used to heat buildings, new knowledge and technique must be used to operate new technologies, other organizations must be used or established, and heat consumers, operators, and installation contractors will find new opportunities to gain profit. If the product changes, different dimensions will change too. However, what makes radical technology changes difficult is that existing institutions often favor a status quo (Hvelplund, 2005). To change a technology, change must happen with stakeholders and/or interest groups. Changes in the diagram above (Figure 6), is not only meant for heat consumers but all mentioned parties. There is a difference between the suppliers of heat (oil contractors, technicians) and heat consumers. The established supply system often only has one purpose, in this case supplying heat. They are specialists within this area and can make investments that only is meant to be functioning as making a profit over a longer period (Lund, 2014). For heat consumers it is different. They do not have the same capital as knowledge and economy to make the same investments, and they are not organized related to a certain technology in the same way as established heat suppliers (Lund, 2014). It is important to notice where the changes are happening and for whom. Just as well, too big a change might be a barrier to the change itself.

5. Analysis 1 – Stakeholders' roles in energy planning

This first analysis will answer the first sub-question of *“What are the roles of the different stakeholders when municipalities plan for energy in today’s Smart Energy System?”*. This will be done by first describing the concept of Smart Energy System to understand what area in energy planning a municipality is responsible for. As well it will be described to what extent municipalities’ energy planning is defined in this research. With knowledge about the energy system and how energy planning is defined, it can be analyzed what Guldborgsund Municipality and other stakeholders have of roles in energy planning. This is done from the planners' point of view, as they are the ones who operate in this subject. This knowledge is important as there are different institutional levels in Danish energy planning and the municipality is the authority that is placed closest to the energy and heat consumers (Jensen, 2019). The results from this analysis will thereafter be possible to compare in the next analysis, Stakeholders’ roles in phasing out oil boilers (see Chapter 6.) when looking into the planning process of individual heating and phasing out oil boilers where the roles of stakeholders might change.

5.1 Smart Energy system

Today’s understanding of the energy system is based on the concept of Smart Energy System. Beforehand, sectors as heating, electricity, transport, and cooling were split into individual sectors, resulting in planning was being made with a silo mentality. A shift in the mindset has made it possible to merge these different sectors and to find synergies to benefit one each other. This holistic approach also makes it possible to plan for a sustainable energy system which is not depending on fossil fuels or nuclear power but instead renewable energy sources and can make the collective energy system being CO₂-neutral. This concept is among others defined by Henrik Lund (et. al. 2017) in a review paper, concerning the shift from *“single sector thinking into the use of coherent cross-sectional smart energy system concept”*, and in Henrik Lund’s (2010) book, Renewable Energy Systems.

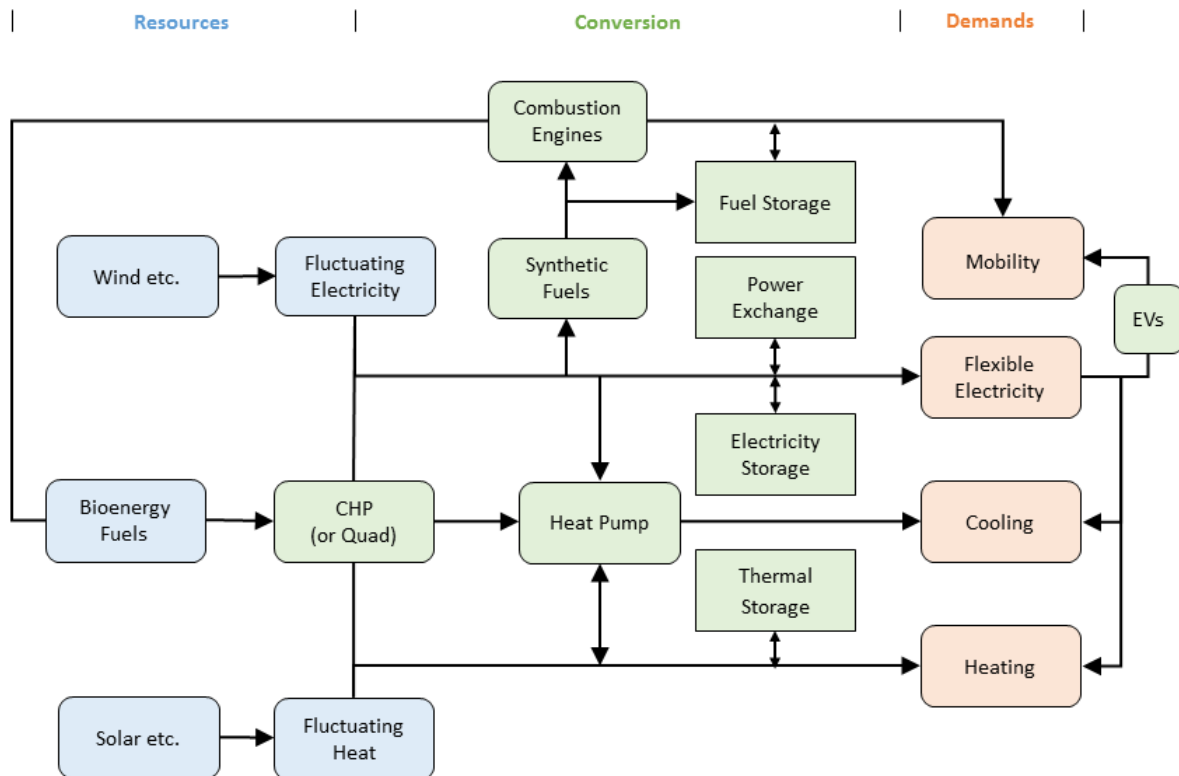


Figure 7: Illustration of the concept, Smart Energy System (Connolly, 2014).

The concept of Smart Energy System consists of the three elements; resources, conversion, and demands (Figure 7). Resources cover different inputs to create energy. This can, for example, be renewable energy sources as wind and solar which is considered as being fluctuating because they only produce energy when the wind is blowing, and the sun is shining. Therefore, an energy system can not mainly consist of energy produced by these sources. There is also a need to use bioenergy fuels in energy production which will help to create a stable energy production. Bioenergy can be in the form of biogas, waste, and biomass like straw and wood. In the next stage, conversion, the different sectors become combined as one type of energy can be converted to other forms. In the combined-heat-and-power plants (CHP) it is possible to produce both heat and electricity. With CHP it is also possible to exchange between the different energy outputs, meaning that when electricity is being produced to a great extent, the CHP can choose to only produce heat instead of also producing excess electricity. Electricity produced from both windmills and CHPs is possible to send directly out to the consumers. Other options are to use electricity for producing synthetic fuels which can be utilized in vehicles for transport. It is also possible to utilize electricity in heat pumps that effectively can produce either heat or cooling. Big heat pumps can be utilized in the district heating production while small individual heat pumps can be installed in individual buildings. In the conversion stage, it is also possible to store energy both as fuel, electricity, and heat. This makes the energy system more

effective and flexible, as energy can be stored when it is cheap to produce and used when there is high demand. In the last stage of the Smart Energy System, there are demands for the different sub-sectors. These will be met through the explained conversion of the different energy sources. (Lund et al, 2017; Lund, 2010)

What is not illustrated in the concept of Smart Energy System is the difference between the heating network and the electricity grid. The electricity network consists of transmission lines that all are connected and stretch all around the country. There are even transmission lines to the Netherlands, Norway, Sweden, and Germany which makes it possible to either export or import electricity if necessary (Energinet, N/A). Because electricity is running on a national network, it is regulated by the Danish Energy Agency (Energistyrelsen c, N/A). Contrary to the electricity network, heat is produced and distributed much more locally. This implies that the planning is done in municipalities by creating plans for heat supply and approving projects for collective heat supply (Energi-, Forsynings- og Klimaministeriet, 2018; §1). Therefore, planning for heat supply will in this research be the definition of energy planning as this is inside the municipality's jurisdiction. This does not imply that a municipality does not have any responsibility for electricity production. As seen in the concept of Smart Energy System, electricity can be produced from solar panels, windmills, and through CHPs, and it is the municipality's responsibility to plan and place technical facilities as windmills and powerplants (Erhvervsministeriet, 2018); §11a-b). The role of the municipality and other relevant stakeholders and their tools in energy planning will be defined in the next chapters.

5.2 The roles of the stakeholders in the municipality's energy planning

In the next subchapters, the different stakeholders who are relevant to energy planning in the municipality are analyzed. These are the municipality, heat consumers, the energy consultant, and utility companies. These have been chosen because of the pre-actor analysis (see Chapter 1.3) and who has been mentioned in the interviews with Guldborgsund Municipality and Rambøll. In the end, the stakeholders' roles will be compared and how much interest and power they have in energy planning (see Chapter 5.3).

5.2.1 The role of the municipality

In this research, today's general energy planning has been defined as being heat planning. However, according to the Danish Agency of Energy's guide to strategic energy planning in municipalities, a municipality has multiple roles and related tools in energy planning and covers more than just heat planning (Energistyrelsen, 2013). This type of strategic energy planning covers everything from the

municipality functioning as a company to the municipality as planning and approval authority, owners of utility companies, and making partnerships, facilitating and informing citizens. Even though strategic energy planning is not a part of this research's delimitation and is still in the process of being fully developed (Jensen & Therkildsen, 2014), it still covers relevant tools to heat planning which also can be found in relevant legislation on this area. The relevant roles and related methods of planning for heat in energy planning can be seen in Table 3. Some of the roles and methods are relevant to today's current energy planning, while others are more relevant in the next chapter about stakeholders' roles in phasing out oil boilers (see Chapter 6.) and has been marked by a star.

The roles of the municipality in heat planning	Methods
The municipality as planning and approval authority	Heat planning
	Phasing out oil and natural gas
	Approval of projects
	Placing biogas plants and solar power plants
	Obligation to connect to collective heat supply*
	Ban of electric heating*
Owner of utility companies	Heat savings*
	District heating and natural gas
The municipality as a company	Waste treatment
	Role model
Partnerships, facilitating and informing citizens*	Information*
	Local resources*
	Financial aid*

Table 3: Chosen roles for the municipality and methods to use in today's general energy planning. Those marked with '*' will be described in Chapter 6. (Energistyrelsen, 2013)

To secure coherent planning in municipalities, one of the roles for a municipality is to be the authority for planning and approval. This holds a municipal responsible for creating a municipal plan, a plan that sets the scope for in what direction they want to see the municipality go, and how they want to work in each sector. This includes planning for establishing new technical facilities and the status of the current heat supply (Erhvervsministeriet, 2018). A municipality is also responsible for creating a plan for heat supply (Energi-, Forsynings- og Klimaministeriet, 2018; Klima-, Energi- og Forsyningsministeriet, 2020). According to the law of heat supply and the act for approval of projects for collective heat supply plants, this plan is meant to be: "i. a. for use of the municipality council's consideration and approval of projects for collective heat supply." (Klima-, Energi- og

Forsyningsministeriet, 2020). These legislations have their focus on planning for collective heat supply like district heating and natural gas. However, natural gas never reached Guldborgsund Municipality because it was not believed to be economically profitable by the supply companies (Pedersen, 2020; 22:05). Therefore, the only option of collective heat supply in Guldborgsund Municipality is district heating. Plans for heat supply are made by the energy planners working in the municipality and as stated in the law of heat supply, it has to be made in cooperation with the utility companies and other affected parties (Klima-, Energi- og Forsyningsministeriet, 2020; §3). This is also beneficial because of municipalities' (part-)ownership of utility companies and they can influence the heat production in a certain direction by planning for expanding the district heating network and utilizing the heat produced from the incineration of waste.

When the final draft of the plan for heat supply is finished, it is up to the city council to either pass or reject the plan. Therefore, the energy planner cannot devise a plan as they want, it must be following the city council's politics. This induces that plans are not mainly professional expert's assessments, but they are also political decisions. This indicates how the role of the energy planner in the municipality no longer is the autonomous planner (see chapter 4.2), who has the power to do what the planner sees most fit. Instead, today's energy planner must be more consensus-driven and must juggle between the political game and still do its professional work the best way possible in those settings.

Guldborgsund Municipality's latest heat supply plan was made after the municipality merge in 2007. This plan occurred in the process of combining the heat and energy plans for the six merged municipalities to get an overview and to see the potentials of expanding district heating (Pedersen, 2020; 3:11). This plan for heat supply was made by Rambøll and is today (red. 2020) 13 years old. because the plan can be categorized as outdated, a new plan for heat supply is in its initial phase. This plan will instead have its focus on the utility companies' heat production. Guldborgsund Municipality wants to get an overview of when the utility companies should replace their current boilers, and what technology they should change to instead. This will be done by looking into how district heating will evolve in the municipality the next 10 to 30 years, to help utility companies make the right investments in new boilers or big heat pumps (Pedersen, 2020; 11:38). Since this is the focus, the plan will not include anything about individual heat production. Instead, it will mainly be made on behalf of interviews with the utility companies in the municipality, and heat consumers will not be included.

5.2.2 The role of heat consumers

Heat consumers are traditionally not included in municipalities' plans for heat supply. In the act of collective heat supply projects, the only mandatory reason for including heat consumers is when their land gets registered to either a district heating or natural gas zone (Energi-, Forsynings- og Klimaministeriet, 2018; §§26 & 29). Likewise, the only mention of the heat consumers in the law of heat supply is when utility companies have to offer prices to the heat consumers (Klima-, Energi- og Forsyningsministeriet, 2020). According to Klaus Fafner from Rambøll, there has not been any tradition to include heat consumers in heat supply plans prior. He gives four reasons why this is the case (Fafner, 2020) [Own translation]:

- The plan is wished by the city council who is representing citizens
- The plan is normally a tool for municipality administration
- There are no specific arenas for the purpose (except the city council)
- It is too complex

The first reason that the city council is representing citizens refers to what form of democracy we are practicing in Denmark. In Denmark, we have a representative democracy where citizens in the municipality are choosing who they want to make decisions on their behalf in the city council through an election. With this form of democracy, citizens let the politicians represent their standpoints, and if citizens are displeased with the politician's decision making, they can elect someone else in the next election. In this way, citizens' interest will be carried without them having to acquaint themselves in every case.

The next two arguments are an argumentation for why it has been a tradition that energy planning has been done without public participation and why it will remain the status quo in the future. Since plans for heat supply mainly is seeing as a tool for the municipality administration and associated decision making, citizens do not have any reason for being a part of the energy planning as they are not the ones who will be using it in their work. This is showed by Klaus Fafner's point that there are no specific arenas where heat consumers can be included in this planning. Since it is believed that heat consumers should not be included there has been no necessity to create an arena where they could be involved.

The fourth reason can also be an argument for why plans for heat supply are made without heat consumers' involvement because energy planning and plans for heat supply are too complex for the common person. As Chilvers (2008) mentions (see Chapter 4.1), some planners do not see the reason for including citizens because some types of planning are too technical. With this point of view, heat

consumers will remain the status of having no direct role in energy planning. In the case of Guldborgsund Municipality, it makes sense that heat consumers are not included in the planning. As Svend Pedersen (2020) mentioned previously, the plan is made for utility companies to see the future scenarios of district heating in the municipality and how the future heat production should change. Since there are no concrete projects or legislation which demands including heat consumers in energy planning, this will remain the case. Svend Pedersen explains this:

"It is too complicated, and citizens do not care to acquaint themselves in it, and maybe they do not have the resources. You can involve citizens in many things but if they cannot see the silver lining or if there is nothing to show them, then they are not easy to push" (Pedersen, 2020; 50:45)
[Own translation]

According to Svend Pedersen, citizens should not be included just to be included, like risked in the fourth ladder of citizen participation, consultation (see Chapter 4.3.1). Svend Pedersen will not use public participation without there is a reason for including heat consumers in energy planning, and in this case, where the plan for heat supply is concentrated on the district heating production, this is not the case. Heat consumers might not even care or maybe they do not have the time or necessary knowledge.

5.2.3 The role of the consultant

Klaus Fafner has great insight into why heat consumers are not traditionally included in energy planning because he has been consulting municipalities many times before in their energy planning but also written municipalities' plans for heat supply if they are not capable themselves. His role has been to gather and communicate information with the purpose that the city council and the municipal administration can make decisions (Fafner, 2020). Jobs like these often consist of gathering information about the development in the energy sector, suggest instruments for the municipality to reach their targets for energy and economy while creating an overview of different actors and stakeholders' interest and involvement. This is illustrated in Guldborgsund Municipality's current plan for heat supply (Guldborgsund Municipality, 2011), as Rambøll has compiled information to describe the overview of the different districts in Guldborgsund Municipality and where there is a potential of expanding the district heating network. In these cases, the consultant becomes a partner for discussion, where content and solutions are being discussed with the energy planner in the municipality. On behalf of the guidelines that are set by the municipality of what to include in the plan for heat supply, consultants have a high power of the results and possible solutions. Consultants do not have a final decision, contrary to the city council, but they are the one who decides what is being

discussed. Therefore, consultants are not responsible for finding what they think is the best solution, but instead coming up with as much information that the municipality can take what they think is the correct decision.

5.2.4 The role of utility companies

In cases where collective heat supply is an option or a possibility in the future, utility companies are included in today's current energy planning too. The utility companies in Guldborgsund Municipality are fully or partly owned by the municipality (Pedersen, 2020; 32:16). This means that the utility companies are subject to public restrictions and must run as a non-profit company. Therefore, their role is to supply heat consumers with heat where it is possible and are not allowed to make any profit. This is to protect heat consumers and to secure a heat supply. Just as well, utility companies cannot spend unjustified money on new heating projects. According to the Danish law of heat supply, buildings can only be supplied with a collective form of heat supply if it is the best socioeconomic solution (Klima, Energi- og Forsyningsministeriet, 2020). This includes both what is best for the environment, the utility company, and the heat consumer. Utility companies archive big influence in energy planning as they are the one who decides which new projects they want to start. These projects do of course have to be approved by the city council but plans for expanding the district heating network or establishing new networks must be done in cooperation with the energy planners in the municipality (Klima, Energi- og Forsyningsministeriet, 2020; §3). This is also the case in the current plan for heat supply:

"It is the utility companies who come with the project about expanding the district heating areas. We only suggest some areas they [red. utility companies] can go out and investigate. That we have done in the plan for heat supply which we have today." (Pedersen, 2020; 48:07) [Own translation]

This indicates that the role of the district heating companies is important when it comes to energy planning in the municipality. The municipality can suggest areas, but it has to be the utility companies that submit new projects to approval in the city council.

5.3 The power- and interest relation in energy planning

Through an analysis of the roles of the different stakeholders in the municipality's energy planning, these can be put into a matrix about how much power each stakeholder has in decision making and their level of interest in energy planning. This will give an overview of the relations between the

different stakeholders which later in this research can be discussed if they need to be changed or if it is fine as it is today (see Chapter 8.1). Furthermore, it can be used to compare stakeholders' different roles when planning for phasing out oil boilers (see Chapter 6.3).

	High power	Medium power	Low power
High interest		Utility companies Energy planner	
Medium interest	City council		
Low interest		Consultant	Heat consumers

Table 4: A matrix including the analyzed stakeholders in relation to their level of interest and power in energy planning in the municipality.

In the box with a low level of power and interest are heat consumers. According to interviews with Klaus Fafner and Svend Pedersen, heat consumers do not have any interest in energy planning, and what is included in a plan for heat supply is for heat consumers irrelevant. As long energy planning happens on an overall level and mainly influences the utility companies' energy production, there will be no reason for municipalities to invest any resources in including heat consumers in their energy planning.

Consultants are also placed as having a low interest in the municipality's energy planning. This is not meant as energy consultants do not care about energy planning. It means that consultants do not have an interest in what municipalities and utility companies decide. Their main job is to present and inform about possible initiatives. This is also why they have medium power. They are not the ones who decide the scope of the planning. Neither are they the one who decides which projects that are best. Instead, they are deciding indirectly by presenting certain projects for the municipality to choose between.

Both utility companies and the energy planner in the municipality have high interest and medium power. Today, energy planning in municipalities focuses mainly on collective heating which includes utility companies in the planning process, and they are naturally placed in the same box in the matrix. They have a high interest in supplying heat to heat consumers as this is their job, and they can submit projects for the city council. However, they cannot start any project before they get approval from the city council as well. Because of the close working relationship in energy planning, both of these stakeholders must work inside the political bureaucracy and work within the city council's political agenda. This again relegates them to receiving less power than the city council.

In today's energy planning, the city council has the highest power of the different stakeholders. They decide the agenda, what projects to start, and in what settings they want the administration to work. Even though they have high power in the energy planning process, this is not their only area of responsibility. They are met with a lot of different cases from different sectors and they cannot be experts for each area. Yet, they will still have an opinion on each subject as this is their job. Therefore, they are placed as having medium interest.

5.4 Sub-conclusion

This analysis has been answering the first sub-question of *"what are the roles of the different stakeholders when municipalities plan for energy in today's Smart Energy System?"*. This has been done by analyzing the concept of the Smart Energy System, legislation on the topic, and interviews from energy planners in Guldborgsund Municipality and Rambøll.

The results conclude that the concept of the Smart Energy System sets the scope for municipalities as responsible for heat planning. This is done in close relation with utility companies, and sometimes with help from external consultants. They are responsible for creating a plan for heat supply and make projects for collective heating. They are all governed by the city council who decides the politics who can decide if plans and projects live up to their agenda and can be proceeded. Meanwhile, heat consumers are not included in the current energy planning, as it is believed not to be relevant and heat consumers will have no interest (Table 5).

Stakeholder	Organization	Power level	Role
City council	Municipality	High	Sets the scope of energy planning through political agendas, and passes plans and projects.
Energy planner		Medium	Makes or contracts out the plan for heat supply, to be made in cooperation with utility companies. Also points out potential areas for collective heat supply to utility companies.
Utility companies	Municipal owned	Medium	Supply heat consumers with collective heat, make project proposals for collective heat supply, and help make the plan for heat supply.
Consultant	Privat	Medium	Helps the municipality make the plan for heat supply.
Heat consumers	Privat	Low	Are the consumers of heat and have no role in energy planning.

Table 5: Table of the different stakeholders' roles in today's current energy planning in the municipality.

6. Analysis 2 – Stakeholders’ roles in phasing out oil boilers

This chapter will answer the second sub-question of *“how do stakeholders’ roles differ from general energy planning when planning for phasing out oil boilers?”*. With knowledge from the previous analysis of stakeholder’s roles in current energy planning in Guldborgsund Municipality (see chapter 5.), this analysis will go a step deeper and study stakeholders’ roles in the process of phasing out oil boilers. This will be done by looking at different stakeholders and analyze what role they have in the process of phasing out oil boilers. here, the remaining methods that can be used by the municipality in heat planning from Table 3 in Chapter 5.2.1 will be included. This analysis will be made on behalf of interviews with energy planners from Guldborgsund Municipality, Hjørring Municipality, and Rambøll to see how the roles of the stakeholder change when planning for individual heating instead of regular energy planning, and if there are any new stakeholders as well. Therefore, this analysis is again done from the planners’ perspective as they are the ones choosing what is being done by the municipality to support this process. In the end, will the different stakeholders be placed in a similar matrix as in the previous chapter (see Chapter 5.3) to make it possible to see how the different stakeholders’ power and interest change. Getting the heat consumers’ point of view will be possible in the next analysis of heat consumers’ views on heat supply (see Chapter 7.).

6.1 The roles of the stakeholders for phasing out oil boilers

6.1.1 The role of the municipality

As stated in the previous chapter 5.2.1, a municipality is required to make a plan for heat supply. In Guldborgsund Municipality’s current plan for heat supply, it is not included how they want to help phase out oil boilers in their municipality. Instead, Svend Pedersen who is the energy planner for Guldborgsund Municipality tells how the municipality has chosen to stay passive as it is believed that the change will happen naturally:

“I believe that there will be a natural change. It might be that the price [for oil] drops because of the [corona] virus. [...] You can imagine as long as the oil industry operates, it can postpone the process. [...] There is not political incitement to go out and talk to everybody who owns an oil boiler. You need to bring a concrete offer for them because it is not free.” (Pedersen, 2020; 27:54) [Own translation]

Because it is believed that the municipality cannot affect oil boiler owners without any economic initiatives or customized solutions, they might as well let the transition happen at its own pace. And

as Svend Pedersen says, this will take some time as long as the oil industry is still operating. This mentality leaves the municipality as passive.

Even though Guldborgsund Municipality has targets for the reduction of CO₂-emissions, this is not used as an argument to plan for phasing out oil boilers. Actually, according to Svend Pedersen, the climate plan where the CO₂-reduction goals have been made, has been down prioritized by the city council. The city council still wants to follow how the development is going, but it will not be used to justify political actions (Pedersen, 2020; 4:55). This might be caused by the municipality's economic situation:

"As a municipality, we do not have any money to use. Economically, we do not have any options. We only have motivation factors. [...] We refer usually citizens to the energy-saving website [Red. www.sparenergi.dk], where they can look at which possibilities they have. In that case, we are more passive." (Pedersen, 2020; 42:44 & 50:45) [Own translation]

The economic situation dictates that the municipality is not able to come up with initiatives to help phase out individual oil boilers. And when the Danish Energy Agency promotes using financial aid in energy planning (Table 3 in Chapter 5.2.1), this is limited to energy renovations instead of changing heat supply (Energistyrelsen, 2013). This is why Guldborgsund Municipality is remaining passive in the role of phasing out individual oil boilers. This is also why information campaigns have not been utilized as well which is the only tool mentioned by the Danish Energy Agency where some sort of public participation is suggested. As the city council is responsible for approving the communal budget, they have the option to make politics and allocate money for such campaigns, but this has been an opt-out. Instead, they have two links on their web-page where they explain what SparEnergi.dk can help with if they are heat consumers or a company (Guldborgsund Municipality, 2018)

Guldborgsund Municipality has previously attempted to cooperate with some heat consumers in two smaller towns, to establish a local district heating network driven by the local citizens. Svend Pedersen explains:

"We were out in a town called Vålse and in a slightly larger town, Orehoved, where there were up to 30 homes and 200 homes. [...] We were cooperating with citizen committees who had a wish about local district heating and we participated by telling about the different things. [...] We made some calculations for how it will turn out in some concrete examples for some of the houses. [...] There was a local farmer who wanted to use his straw and he wanted to lay out some of his lands for a local heating plant. [...] Then there was a cooperation with the local enthusiasts where we had them on a field trip so they could see other small local heating plants and how they worked. [...] We have had some local enthusiasts, but they became tired. We have had the process running for four to six years, and you can say that it is a long time to motivate the citizens. Because it should be the citizens' project. That was what we focused upon. [...] The areas died eventually. We told them that if it gained

enough support then we could take it up again, but then they had to do most of the work themselves. Because at that time we had already used a lot of resources, and we did not want to go through it all one more time.” (Pedersen, 2020; 15:00-20:45) [Own translation]

Even though there were good intentions with these projects about a local collective heat supply in the smaller towns, it did not end successfully. The municipality put them self at disposal to give advice and making economic and technical calculations. They even brought the citizens to other successful cases in other towns. However, because the process took too long, the local enthusiasts got drained of energy, and the projects ended in nothing. In a follow up from Svend Pedersen, he explains that there were several reasons for the prolonged process (Pedersen b, 2020). First of all, not enough resources were put towards these projects as there were running different projects simultaneously. Second, the heat consumers were afraid it will become too expensive compared to their current form of heat supply. Because the municipality could not give any guarantee, heat consumers would rather choose the safe option with individual heating. Therefore, Svend Pedersen does not see a future with small local district heating plants:

“When I see how smaller existing district heating supplies struggle at the moment, as houses become abended, then I do not think that a collective heat supply is a solution in small towns. I believe more in subscriptions solution [of heat pumps].” (Pedersen b, 2020) [Own translation]

This has resulted in that the municipality only wants to go into such a process again if there is local support and the local citizens do most of the work themselves, and even so, Svend Pedersen personally rather see people getting individual heat pumps through subscriptions even though the municipality does not promote this option anywhere. Accord to the theory of public participation by Annika Agger and Birgitte Hoffmann (2008) (see Chapter 4.3), this example can be a barrier for public participation in the future. Because the project ended up in nothing after four to six years of work, heat consumers can be distrustful of the municipality in future projects. The theory also mentions that prolonged projects most often will end in fiasco as citizens become drained of resources, as it was in this case.

6.1.2 The role of heat consumers

As illustrated by Svend Pedersen about the two local collective heating projects, some heat consumers in Guldborgsund Municipality have shown that they have had the interest to get a new form of heat supply which indirectly will result in phasing out oil boilers. This was all started by local enthusiasts, but this interest has disappeared in line with the projects that never succeeded. Even though heat consumers do not have an influential role in today's energy planning, they still have the most

important role when it comes to phasing out oil boilers. Today, no public authorities can decide when heat consumers must substitute their oil boilers with another form of heat supply (see Chapter 1.2). This leaves oil boiler owners with the absolute power of when this transition will happen. Just as well, heat consumers can also decide which form of heat supply they want if they are not located in a zone for collective heating. And by local enthusiasts showing interest in district heating, a potential arises for a change in heat supply. However, other stakeholders might try to influence them to what they think is the best choice, but heat consumers will always end up with the final decision. Even though heat consumers have the highest power when it comes to phasing out oil boilers, this is not necessarily the case when it comes to interest in phasing out oil boilers. Klaus Fafner comes with an explanation:

"[...] a part of the population does not prioritize the climate. Because the climate has been discussed in the last decades, it must mean that citizens who still have oil boilers today must be the ones who are less willing to change." (Fafner, 2020) [Own translation]

Instead of having an interest in phasing out oil boilers, current owners of oil boilers might have an interest in not changing as some kind of statement. According to Klaus Fafner, heat consumers who have an interest in phasing out oil boilers have already made the change. This concludes from both the interview with the municipal and energy consultant that the remaining heat consumers who still own an oil boiler are not interested in phasing them out. However, this is the experts' point of view where it will be analyzed in the next analysis from the citizens' perspective, what reasons they have for either changing or not changing their heat supply (see Chapter 7.).

6.1.3 The role of banks, technicians, and salesmen

In the two examples of citizen involvement, the municipality also brought local banks and plumbers to the town meetings. Svend Pedersen explains their role:

"We also brought bankers and local plumbers so they could explain what it will mean to have a water-driven heat system and then you could get the bankers to tell a little about obtaining a loan and how it could be financed. [...] If a bank should borrow out money, they need security. They do not want any losses at all, so they do defiantly not do any voluntary work." (Pedersen, 2020; 18:14, 45:05) [Own translation]

Plumbers were brought to give technical explanations of how it would work in heat consumers' houses if they chose to change to a local district heating system. They could also answer questions about how heat consumers could scrap their current form of heat supply and how this new one would be installed. Therefore, plumbers would have a great interest in people transitioning away from oil boilers to other types of heat supply as it means more work. However, they would not have a direct saying in

oil boiler owners' choice, but it could be done indirectly if they offer cheap installations. Just as well, they can give counsel of which solution they think is most optimal in each heat consumer's case. This could be the solutions of heat pumps, pellet boilers, or if the customer should make contact with the district heating company to connect to the district heating network. However, if the plumber is most specialized in one kind of solution, this will maybe be the one they suggest.

Banks do not have a specific interest in phasing out oil boilers unless they can benefit financially. For them, it should pay before helping heat consumers financially. This leaves the bank with the power of deciding which solution citizens can choose between based on loans as some of the solutions are more expensive than others. However, if heat consumers have enough money saved up, they can choose not to loan money from the bank, and the bank becomes irrelevant in those cases.

In the initial interview with Hjørring Municipality, energy planner, Thomas Jensen also brings up service engineers and salesmen of oil boilers as stakeholders with great interest in keeping people keep their oil boilers or changing to a new version:

"Salesmen of oil boilers and the ones who maintain them complained a lot at the start. However, in the end, they became good actors and team players. They could see that they should find other forms of work in the future to adapt" (Jensen, 2020; 14:00) [Own translation]

In opposition to plumbers who would like to see a transition away from oil boilers as they would get more work no matter the type of solution, people who are in the oil boiler business would like to retain their same relevance. Therefore, they have an interest in people either keeping their old oil boilers or when they need to change it, they buy a new and more efficient one. Still, they do not have any power except giving favorable prices compared to the other solutions.

6.1.4 The role of utility companies and the consultant

Utility companies do also have a potential role in phasing out individual oil boilers. Utility companies only have a role in phasing out oil boilers when they can offer collective heat qua the conditions in the law of heat supply. If there are homes with installed oil boiler in zones for collective heat supply, the utility companies have different options to make heat consumers scrab their oil boiler instead of district heating. Svend Pedersen from Guldborgsund Municipality explains that utility companies have the option to invite to town meetings and to make campaigns (Pedersen, 2020; 38:28). To make sure enough customers will choose district heating, utility companies must persuade heat consumers to choose their option of heat supply, as if not enough is choosing it, collective heating will not be the best socioeconomic solution. If it is realistic with district heating, utility companies have a huge

interest in phasing out oil boilers in favor of their product. Still, they do not have any power to make heat consumers change here and now. However, in cooperation with the municipality and in the making of the plan for heating supply they can expand zones for collective heating which takes away oil boiler owners' option to replace their old oil boiler with a new one. If there cannot be established district heating, utility companies can still maintain the same role if they estimate that a local heating supply solution can be an option. Furthermore, four utility companies have been granted subsidies to sell heat pumps through subscription (KILDE). These utility companies are not bounded to geographical areas and can sell heat pumps to heat consumers in all of Denmark. According to calculations from *Dansk Fjernvarme*, this option has a much lower start-investment but will be more expensive long-term compared to self-purchased heat pumps (Dansk Fjernvarme, 2019).

For assistance, utility companies can use external consultants. Here Klaus Fafner from Rambøll tells that they help utility companies with consulting the individual house owner about how they can scrap their oil boiler and how a district heat unit could be installed in their house (Fafner, 2020). This shows that consultants only have an interest in phasing out oil boilers as a part of their work. Neither, the external consultant has no significant power in phasing out oil boilers because they are hired by the utility company to be consulting heat consumers who already have chosen district heating.

6.2 Stakeholder's changed power and interest relations when phasing out oil boilers

Just like the previous analysis (see Chapter 5.3), stakeholders will be placed in a matrix for how much power they each have in the process of phasing out oil boilers and their interest in the same. This will give indicators of how stakeholders' roles have changed when focusing on individual heating and oil boilers compared to general energy planning for the municipality. As well, it will give an insight into who could be involved in a participatory process and what obstacles there can be to get the different stakeholders engaged (see Chapter 8.).

	High power	Medium power	Low power
High interest		Utility companies ^(M/H)	Plumbers ^(New) People in the oil boiler business ^(New) Other heat consumers ^(L/L)
Medium interest		Banks ^(New)	
Low interest	Oil boiler owners ^(L/L)	City council ^(H/M) Energy planner ^(M/H)	Consultants ^(M/L)

Table 6: A matrix including the analyzed stakeholders in relation to their level of interest and power in phasing out oil boilers. Letters in the brackets tell what level of power/interest the stakeholders had in energy planning. L=low, M=Medium, H=High.

On behalf of interviews with Guldborgsund Municipality, Hjørring Municipality, and an energy consultant from Rambøll, oil boiler owners are placed as having a low interest in phasing out oil boilers, which is the same level of interest as in energy planning. This is because oil boiler owners simply do not care about what kind of heat supply they have and the related environmental consequences. This is opposite to other heat consumers who have chosen another type of heat supply. It can be argued that heat consumers who function as local enthusiasts in their community can be placed as having a high interest, but since there are no recent projects, this is not the case today. Those heat consumers who still use an oil boiler are also the ones with the most power which is a total reverse to their level of power in energy planning. They can decide if they want to change, when they want to change, and to what other forms of heat supply they. Meanwhile, heat consumers with other options of heat supply do not have this power anymore.

Also with low interest in working towards phasing out oil boilers, are the city council and the energy planner in Guldborgsund Municipality. Both stakeholders have less interest in this subject compared to general energy planning because they have chosen to let the process of oil boilers out-phase themselves happen naturally. Still, they have a medium level of power as they can choose to make politics, give financial aid, and create informational campaigns that can help motivate oil boiler owners to phase out their oil boiler to another form of heat supply. However, this has not been chosen to be done. Therefore, the city council's level of power decreases while it for the energy planner stays at the same level.

Utility companies have a high interest in phasing out oil boilers, the same level interest as in general energy planning. This is due to their job to supply heat consumers with collective heating. Even though they are placed with having high interest, they still only have a medium level of power to phase out oil boilers. It is oil boiler owners' choice if they want to change their form of heat supply or not.

However, they can expand the district heating zones if it is socio-economically cost-effective. This will take away the right to substitute an old oil boiler to a newer version in the future.

With both low power and low interest is the consultant. The reason why the consultant has the same level of interest and a lower level of power compared to current energy planning is that this is not part of their job to help phase out oil boilers. They are helping utility companies when it is necessary, but only in cases where it already has been decided that a district heating system will be installed.

Plumbers and people in the oil boiler business are new interest groups compared to energy planning in a municipality and both have a high interest in the process of oil boilers being phased out. Oil boiler technicians and salesmen of oil boilers would like to postpone this transition as long as possible, otherwise, it will have consequences for their work. However, those service technicians who have experience in scrapping old oil boilers and installing new heat supply solutions have a great interest in seeing oil boilers being phased out. Still, both of these stakeholders have little to decide if oil boilers should be phased out or not. The only power they have is by talking with heat consumers and offer greater deals to either remain or changing heat supply. And this contact must be in the first place be taken by heat consumers when they want to find an alternative to their current heat supply.

Banks are also a new stakeholder in the process of phasing out oil boiler. They have a medium interest as they can choose between if they want to grant loans or not on behalf of if they see it as beneficial or not. Therefore, they also have the power to decide if oil boiler owners can afford to buy a new heat supply or not if heat consumers do not have the money. However, if heat consumers have the money, the bank becomes irrelevant.

6.3 Sub-conclusion

This analysis has been answering the second sub-question of *"how do stakeholders' roles differ from general energy planning when planning for phasing out oil boilers?"*. This was done by interviewing energy planners from Guldborgsund Municipality, Hjørring Municipality, and Rambøll to get their view of the different stakeholders' roles when phasing out oil boiler. This could then be compared to the results made in the previous analysis (see Chapter 5.4).

This analysis concludes that most of the stakeholders' roles change when focusing on phasing out oil boilers instead of current energy planning in the municipality. Most important is that oil boiler owners have the deciding power to choose if they want to change to another heat supply or not. However, they are according to the interviews still not interested in such a process, opposite to the ones who

have changed heat supply already. Because of the low interest from oil boiler owners, Guldborgsund Municipality has chosen to stay passive in the transition where they had much more to say in the general energy planning. Utility companies maintain their previous role and are only relevant when they plan to expand or establish new zones for district heating, which denies current oil boiler owners getting a new oil boiler. External consultants do not have any significant role in phasing out oil boiler, as they are only hired by utility companies when heat consumers have chosen to change to district heating. In the end, banks, plumbers, technicians, and salespeople in the oil boiler business are new stakeholders that are not included in the general energy planning in the municipality. These stakeholders are relevant when oil boiler owners consider changing their old oil boiler for something else. Their role then becomes to make these heat consumers choose the solution which is relevant to their field of expertise and work, and for banks how much money heat consumers can loan. (Table 7)

Stakeholder	Organization	Power level	Role
Oil boiler owners	Privat	High	Can choose between different types of heat supply or keep their current form.
City council	Municipality	Medium	Is passive and letting the transition happen naturally.
Energy planner		Medium	Is passive and only helps oil boiler owners by referring to a web-page with more information.
Utility companies	Municipal owned	Medium	Can offer collective heating to oil boiler owners in collective heating-zones and propose projects to establish collective heating as an alternative for oil boilers.
Banks	Privat	Medium	Can issue loans to oil boiler owners if they see it financially beneficial.
Consultant	Privat	Low	Helps utility companies when new customers have chosen collective heating.
Other heat consumers	Privat	Low	Has no role, as they have already another form of heat supply.
Plumbers	Privat	Low	Tell about possible solutions and give offers to oil boiler owners for new heat supply.
People in the oil business	Privat	Low	Give offers to retain oil boiler owners using oil in their future heat supply.

Table 7: Table of the different stakeholders' roles phasing out individual oil boilers.

7. Analysis 3 – Heat consumers' views on heat supply and public participation

This chapter will analyze heat consumers' points of view and answer the third sub-question of *"how do heat consumers want to be included in the transition to other forms of heat supply?"*. This will be done by firstly investigate what factors are important to heat consumers when changing the type of heat supply. Next, it will be scrutinized how heat consumers want to be included in energy planning, or if they even are interested in such public participation. Based on this analysis, and the results from previous analyses, it is possible to discuss what is needed to make it possible to make oil boiler owners transit to other types of heating supply in the next chapter (see Chapter 8.).

This analysis is made based on seven interviews with different heat consumers in Guldborgsund Municipality. Most of them either have different types of heat supply today or have changed away from different types of heat supply as well (see Chapter 3.3.2). This includes oil boilers, different types of heat pumps, district heating, electric heating, and wood pellet boilers. Not only current or previous oil boiler owners are included in this analysis as people with other types of heat supply might have points of view worth considering as well or might be a benefit in potential public participation.

7.1 Factors for heat consumers' choice of heat supply

As introduced, the first part of the analysis will analyze the factors heat consumers consider when changing the type of heat supply. These parameters are the economic aspect, the environment, convenience, uncertainties of the future, and heat consumers being indifferent. This knowledge can be used in the potential work of public participation and to find the best way to make people change away from oil boilers. It must be stated, that all statements and quotes might not represent every heat consumers' view as people are different, have different houses, and have different priorities when it comes to choosing heat supply.

7.1.1 Economy

The economic aspect was mentioned in all seven interviews. When people looking into getting a new type of heat supply, they are most inclined to choose the option which is the cheapest. When considering what option is the cheapest, many aspects are being counted for. In an interview with a heat consumer who changed from an oil boiler to an air-to-water heat pump which was bought as a subscription, the heat consumer tells about the difference in prices and how it made him choose:

"You pay 60,000 kr. in advance and 1,500 kr. quarterly and that is all. Those 1,500 go to administration and spare parts and they say if it breaks down, they will replace it with a new, free of

charge. [...] Let us say I should have this [new oil boiler], then it is with these new oil burners where the smoke is colder, and your chimney must be renovated or isolated. And that costs money as well [...] That was too expensive and will cost a least 120,000 kr.” (Rico, 2020; 07:55; 11:10) [Own translation]

Rico tells that it is a matter of course that you, of course, choose the option that is the cheapest. He has made the calculation and choosing a more expensive solution will not make any sense. Because it is not only the option of heat supply that must be bought, it is also required renovations as the chimney which must be counted for. Other people also mention this aspect when choosing to buy a new heat supply. One person did not have a water-driven heat system in the house and the options were between implementing a water-driven heat system by leading tubes through the floors, or an option where a water-driven system was not necessary. Here he chose to install two air-to-air heat pumps because this was the cheapest solution (Ole, 2020; 06:55). Rie describes the experience as well when choosing to install a new oil boiler in replacement for the old one:

“It is a big expense when purchasing a new heat supply system, and you have to think long-term. With the radiators we have, then you could just use the old ones by changing to a new oil boiler. Maybe they could not handle it if we changed to another source of heating, then they might have to be replaced. [...] So, it ended up being the cheapest option given that we reused some of them. [...] You have to know how much money you can use on this solution.” (Rie, 2020; 12:01) [Own translation]

“And you have to look forward if you want to stay in the house. If the source of heating has to be used in 10 years or if you should move.” (Rie, 2020; 05:58) [Own translation]

The examples of Rico and Rie show for some people, the cheapest option might be to get the same type of heat supply as the previous heat system already supports it. Each home is unique, and the same solution might not work for every home. Second, it is also a prioritizing of how long the heat consumer thinks they will stay in the house. If the heat consumer is getting old or has plans of moving away, it might not be the most optimal solution to invest too much money in new heat supply. Especially in an area as Guldborgsund Municipality where house prices are very low compared to the price of an investment which would be necessary (Boligsiden, 2020).

For other heat consumers, they see getting a new heat supply as an investment where they are going to save money in the long run. One of the interviewed heat consumers is supplied by district heating and wants to change to a heat pump as district heating is very expensive compared to other options of heat supply or other areas' district heating. When it comes to economy and expenses Frederik says:

“Economically, it is just an investment that will come back qua it cost this much to having district heating yearly. I will think in a 5-6 years period it will be paid in the form of savings.” (Frederik, 2020; 10:55) [Own translation]

For some people, they can afford to invest in new heat supply because they are going to live in the same house in the period it will take to make the money back from the investment, and because they have the money to invest in a new form of heat supply in the first place. Another heat consumer, Hanne, also saw buying a heat pump as an investment compared to the old heat supply, but they did not know how long it would take to earn itself home. However, she and her husband have become positively surprised that they are saving 50 % on their heating bill (Hanne, 2020; 11:07). However, it is not everybody who has the money to invest in a new type of heat supply. This is the case for Niels (2020). He has to wait in one to two years before changing from an oil boiler to another form of heat supply because he does not have the money today. And if one does not have the money, it is neither possible to take a loan in the bank. Rico explains this:

"You cannot loan money for renovations today. You can only get a loan if the bank is secured to get the money back from a sale of the house. And the sale around here is not great." (Rico, 2020; 33:40) [Own translation]

With the problem of house prices being low or not being sold, banks are not willing to give out loans for energy renovations. People are forced to save up the money themselves, something, not every heat consumer is able to. For some heat consumers, they do not want to save up that kind of money, as they might plan to move away anyway. For new homeowners, investing in a new heat supply system can end up costing just as much as half of the house, and it might not end up being their number one priority (Ole, 2020; 10:13). Instead, some wait to act as they expect some kind of subsidy from the state to change their oil boiler to another and more sustainable type of heat supply as the Government has the target to reduce CO₂-emissions with 70 % before 2030 (see Chapter 1.1). This is both told in the interviews with Niels (2020), who waits to change the oil boiler and with Ole who says:

"I am sitting on the fence at the moment because I really want to find something else than the oil boiler. But, I have a feeling that if I wait long enough then someone will come and give me an economic push, help. [...] Then you can discuss if the Coronavirus means that nothing can be afforded. But there are still some politicians who say no matter the corona or not, there are still some obligations to the 70 % [CO₂-reduction]." (Ole, 2020; 20:12) [Own translation]

It seems that some heat consumers are waiting to swap out their oil boiler to when they can get financial aid from the state. However, it is not known if new subsidies will be given to oil boiler owners in the future. Today, there are some subsidies to scrap one's old oil boiler, but these people are either waiting for a much bigger financial help or a ban of oil boilers which might lead to economic help. But as Ole says, this might not be the case after the Coronavirus costing the Danish state a lot of money. One thing is for sure that with no information about the state wants to give any subsidies or not, some people are postponing their transition away from oil boilers.

7.1.2 Environment

A second element that was brought up in the interviews was if the environmental impact influenced the choice when changing heat supply. In this case, there are people both being pro-environment and some who do not take it into consideration. In one interview, a couple explains why they chose to change their old oil boiler to a wood pellet boiler instead:

"Flemming bought it [Red. a farm] for over 40 years ago and have been renovating it continuously, climate-wise as well. And there was an oil boiler and a wood stove, and that oil boiler we decided for 20 years ago that it should be renovated. And then we decided to replace it and it should be some more sustainable. Then it became a wood pellet boiler." (Merethe, 2020; 1:41) [Own translation]

"Maybe, it was also because it should be cheaper with wood pellets, but it was not. However, we have heat in more rooms." (Flemming, 2020; 4:44) [Own translation]

This couple had the plan to change their old boiler, and the criterion was it had to be environmentally sustainable. 20 years ago, the sustainable option was a wood pellet boiler, and they hoped that it will become a cheaper option of heat supply too, but this was not the case. Therefore, the environmental factor must be weighted higher than the price. Another element to the story is Flemming's job is to maintain and operate the boilers in the local heat-and-power plant. Because they live on a farm with a bigger wood pellet boiler than normal, Flemming's technical knowledge about how to operate such a system could have been a deciding element as well.

In other cases, it is a prioritization between the economy and the environmental factor. Ole who has bought a house with an oil boiler to rent it to his daughter and son in law wants to change the oil boiler into a heat pump. When asked if it is because of the environment or the economy he says:

"I have an interest in both. I really want to choose a sustainable energy source. That I think is important but if there are two sustainable solutions, then I will choose the one that is best financially." (Ole, 2020; 13:34) [Own translation]

For Ole, a sustainable solution is important, but the cost also has a final saying. Ole has two air-to-air heat pumps in its own house which are significantly cheaper than other types of heat pumps. And because he is happy about these cheap heat pumps, this could end up being chosen in his daughter's house even though it might not be the most effective. In another case where it is a prioritization between the cost and the environment is for Rie who chose to change the old oil boiler out with a new oil boiler. Rie explains if the environment was ever an impact in the decision making:

"Preferably, we had found another solution. It was actually that we wanted to prioritize in another solution, but it became economical much more expensive and became dropped." (Rie, 2020; 10:47) [Own translation]

This shows how some heat consumers use the environmental impact as a steppingstone to investigate other solutions than oil boilers as their heating supply. However, even with good intentions, there is a financial reality, and if someone cannot afford something like a heat pump, they must settle for something cheaper and maybe less environmentally impactful.

In other cases, the environmental impact is not an aspect that is considered when choosing a new type of heat supply or if they want to change at all. Rico, who recently got an air-to-water heat pump in favor of an oil boiler, answers if the choice was based on the heat pump being better for the environment:

“Yes, that is of course also the case, but not as a prioritization. [...] And then you have to consider that most people in the town are older persons, and they do not think about the environment or why should they invest when we might only have 10 years back to live in.” (Rico, 2020; 12:18; 17:34) [Own translation]

For Rico, the environmental impact on the choice of heat supply has not been considered when choosing a new heat supply. However, it is not because the heat consumer is in opposition to the environment. It is more seen as a bonus when choosing what was the cheapest option as seen in the previous part. This is also the case for other older heat consumers. They might have different priorities because they only have some years left of their lives, and what they spend their money on is more short-sighted as they want the benefit as soon as possible. The environment not being a factor in decision making is also explained in the interview with Niels. The heat consumer is not up for all that “CO₂-hysteria” but the solution should still make sense. Shipping wood pellets from all around the world to use as fuel does not make sense for him. Instead, Niels wants to be self-sufficient with wood chips from their wood (Niels, 2020).

7.1.3 Convenience

A third element that also was brought up in some of the interviews was if a new solution was convenient. This covers what solutions are possible in the heat consumer’s houses, how much work it takes to implement a new heat system, and the work it takes to maintain a heating system. One form of heat supply has been referred to as inducing too much work, and this is the wood pellet boiler. Ole says:

“No, that I do not really want as it requires more work than a heat pump. Such a chap has to be fed and looked after.” (Ole, 2020; 17:00) [Own translation]

And this is not the only person who describes having a wood pellet boiler as having a living creature that demands constant attention (Hanne, 2020). Heat consumers with wood pellet boilers must continuously buy wood pellets, it has to be cleaned regularly, and for some it can be physically

demanding to carry and refill new wood pellets, especially for older people. Rico explains that it would be too demanding for the back (Rico, 2020; 13:36), while Rie who got a new oil boiler explains the refilling process of oil to be much easier:

“Firstly, I am a full-time employee and my husband is a disability pensioner because first, we talked about a wood pellet boiler. However, it demands, considered where our heat supply is placed, [...] we will have to refill it manually [...] the boiler is in the basement. It will be a problem when lifting bags when one is disabled [...] We really wanted to stay in the house, so we had to find another solution.” [When asked about refilling an oil boiler] *“Well, then a company comes with a tank, and it runs by itself where it is supposed to go. It is easier.”* (Rie, 2020; 4:28; 6:27) [Own translation]

Too much work maintaining one type of heat supply is a barrier for choosing a wood pellet boiler, and this could be the reason why only one of the interviewed heat consumers is operating with one today. That a type of heating supply is easy to maintain is therefore important for heat consumers.

Another convenience factor is how easy or difficult it is to implement with heat consumers' current heat system. For Flemming, replacing the old wood pellet boiler will be too much work, while for Ole, the choice was made of what technology was possible in the current situation:

“Yes, either it should be a new wood pellet boiler, or else it should be a heat pump. But, if it should be a heat pump then you have to dig up all the floors for floor heating. And we are at that stage where we do not want that, and therefore, we are probably selling it [the farm] and someone else can take over.” (Flemming, 2020; 6:55) [Own translation]

“Well, the reason that I have deselected air-to-water heat pumps, it is that there has never been central heating in the house [...] there are no radiators.” (Ole, 2020; 07:47) [Own translation]

This shows how some solutions are not possible for some heat consumers, either because they do not want to bother or because it is not physically possible without making another renovation. It indicates that a new type of heat supply must be easy to implement and without having to change too much in the current system in their house. This is also the case for geothermal heat pumps where one needs a big enough area to lay down tubes for water circulation. For those heat consumers where this option is possible, this is a preferred solution. Frederik says:

“Heat pumps. There are also geothermal heat pumps. Our house is located next to a field and it is possible to lay down tubes deep enough. That is an alternative we have investigated (Frederik, 2020; 4:45) [Own translation]

By having a big enough area for tubes, it opens for the option to get a geothermal heat pump. However, if one lives only with a smaller garden, the option will never be possible as in the case with Hanne (2020) who instead chose an air-to-water heat pump.

7.1.4 Uncertainties of the future

The fourth factor that influences heat consumers' choice to change heat supply and to what option, is the uncertainty of the future. This both includes if their current heat supply can last, but also how do the perception and consequences of different options change in the future. One example of this has been explained under Economy in Chapter 7.1.1 as heat consumers are waiting for a financial contribution from the state to scrap their oil boiler. Something that can postpone the transition away from individual oil boilers. In another case where the fear of an amendment can entail an uncertainty is exemplified by Hanne. She is in the process of investing in a new rental building which has a wood pellet boiler:

"You can be a little nervous with that building we have invested in if we continue with that project. There is a big and nice pellet boiler and it is only from 2010. And you can be a little nervous if there suddenly comes an amendment." (Hanne, 2020; 13:18) [Own translation]

Lately, there has been a debate ongoing if biomass is CO₂-neutral (Petersen & Bossen, 2018), and this causes uncertainty if you have to save money to another type of heat supply, just like if one has an old oil boiler. Niels also considers the unknown future as a factor for changing his old oil boiler. This is caused by the uncertainty of the price of oil. Especially in the time of the coronavirus, when he hears about the price of oil dropping massively, but in the future, it might increase to double (Niels, 2020).

An element that heat consumers can control is to change their old oil boiler while it is still working but before it breaks down like explained by Flemming:

"No, it still worked but it is like that it will be annoying if the boiler leaked in the winter. Then it was no shame to change it out." (Flemming, 2020; 9:39) [Own translation]

This has been the case for all interviewed heat consumers who previously has had an oil boiler (Rie, 2020; Rico, 2020). However, the intention of changing out the oil boiler also often happens when it has been operating for some years. But as none want to have a house without any heat in the wintertime, it is with due care to change it before it breaks down. Then the question is what to change to? In many cases, the option to get supplied by district heating has been investigated and hoped for. Rie tells how they have been waiting to change heat supply as they were hoping to connect to the district heating network:

"You postponed it as long as possible and hoped for that district heating came out to us. If it comes in the one end of the road, then you gamble that it ends at the other end of the road, but it never did. There was too far between the houses." (Rie, 2020; 15:41) [Own translation]

This indicates how some might postpone changing their oil boiler as they hope for district heating will expand to their house. However, it can be difficult if there is a low density of houses as in this example

with Rie. Ole did also investigate the option to connect to the local district heating network but was told it will never reach his house (Ole, 2020; 06:55). Hanne, who is very pleased with their heat pump also considers if they should install a heat pump in their house in Roskilde as well:

“Well, if we had the money or could get in reasonably financed, then I think we will consider it in Roskilde too, but the problem is that district heating is right around the corner, so should you?” (Hanne, 2020; 9:15) [Own translation]

Most of the heat consumers seem to be pleased if they could connect to district heating, and therefore, they are willing to postpone investing in other types of heat supply. Like in the example of Hanne, who does not know if they should install a similar heat pump like the one in their house In Guldborgsund Municipality, because getting district heating is still preferred.

7.1.5 Uninterested

For some heat consumers, what kind of heat supply they have do not have any interest while others are reluctant for any change. Heat consumers who have been interviewed in this research have all been interested and reflective of their choice of heat supply. However, some of them can tell about neighbors or other people in the community where this is not the case. One example is from Frederik who see people being satisfied with what they have:

“Houses must be isolated and renovated. However, some people are used to settle, and then they are choosing not to do anything with their house.” (Frederik, 2020; 13:31) [Own translation]

This is, of course, Frederik’s point of view, as there might be other factors present for those people why not to do any necessary renovations in their house as changing heat supply. However, from this statement, it shows that Frederik can be annoyed at those people. It is called a choice not to do anything, as referring to everybody are having the same options as him. Frederik also prioritizes the environment highly and ends up being uncomprehending on behalf of other’s choices.

As explained by Svend Pedersen (2020) from Guldborgsund Municipality, there have previously been attempted to establish local district heating networks in Vålse and Orehoved. One of the citizens from Orehoved, Rico, tells his side of the story, and how the project got turned down by too little support and a negative sentiment:

“It happened two years ago that there was a project [...] that they wanted to make a district heating system in Orehoved, but before it could be possible then should about 90 attend. And then it could be a possibility if anybody outside the town who wanted to attend could get it too. [...] There was a limit for how far out it could go. [...] And then some people said: let us wait and see if it becomes a thing [...] Then it turned out that after having some town meetings that it could not surpass

60 inside that area that was chosen. Not the town itself but also outside the town. And then that case was dead. It could not pay. [...] it was us citizens who started it, or it was more specific one man. He thought it was a good idea. He became really mad because he had used so much time on it and it turned out in nothing. [...] It became in a way ruined a little by one person who had heard something about a heating plant in Stubbekøbing, and it was truly negative what he brought up.” (Rico, 2020; 2:00; 5:34; 16:04) [Own translation]

This illustrates firstly, how some people’s distrust in an ambitious project can stop the process because of too little support. Secondly, it shows that one person’s opposition can escalate people’s mistrust to a project even though the person is not forced to connect to the potential district heating network. However, for the reluctant people, it is in this research unknown why they are not willing to help establish a local district heating network. It could be because they are too conservative about new things, maybe they want to be sure they are not settling for a too expensive solution, or because they think it is not important. No matter what, there will always be some reluctant people when it comes to changing heat supply. It has to be remembered as well, that 60 houses wanted to be supplied with district heating, and that one person's work could start a project to potentially replace oil boilers with district heating.

7.2 Heat consumers’ view on public participation in energy planning

After getting an understanding of what heat consumers are considering when changing heat supply, it will be investigated how and if the heat consumers want to be a part of public participation. This is investigated to see if Guldborgsund Municipality has acted correctly by letting the transition of oil boiler happen without any intervention as they believe heat consumers are not interested in energy planning. Or maybe heat consumers are interested in some form of energy planning and want to be included in a public participation process.

In all of the interviews, heat consumers wanted to be included by the municipality or include themselves in the context of helping others changing heat supply. Merethe explains why it could be important and why she wants to get district heating expanded to local communities as well:

“Now, I am some kind of local enthusiast and interferes with everything. Then, of course, I want that. I would like if municipalities handled the problems with heat demand out in the rural districts. In that small town, we are moving to, there are no district heating either. [...] Where we are building [a new house] it is a demand to have water driven [heating system] and that is why it has become geothermal heating. But it is a problem that many choose a solution with wood from the forest and that is not necessarily always good. That is why we think it could be very important if we could get that debate.” (B, 2020; 13:43) [Own translation]

To avoid people choosing less optimal and not sustainable solutions when changing heat supply it is a wish that the municipality takes responsibility and creates a dialogue with the heat consumers. For some heat consumers, they will choose a sustainable heat supply, but this might not be the case for everybody as they do not have the necessary knowledge. Another reason for the municipality to include heat consumers in energy planning is described by Frederik:

"If you do not include society in infrastructure then you might get some who works against it directly. And that can also create some form of misunderstanding which might do not have anything to do with reality. You see it often when wildfires are created on Facebook and other media." (Frederik, 2020; 16:17) [Own translation]

To avoid any opposition to planning made by the municipality, it is important citizens are included in the process, also when it is about heat supply. Especially with social media that can connect a community and where a negative mood easily can escalate. This is also mentioned by Agger & Hoffmann (2008) in Chapter 4.3 who describe that ignoring citizens can create a reluctance towards a project. This indicates that heat consumers must be included in some way. In the next sections, it will be analyzed how heat consumers want to be included in public participation.

7.2.1 Public meetings and networks

A common request by the interviewed heat consumers of how they want to be included in energy planning is through public meetings. This is especially preferred as in many of the small towns there are strong local communities where people are helping each other. Frederik explains:

"I believe [in public meetings] in those cases where there is a local community. Kettinge is locally strong. We have good solidarity where one helps the other and the third helps the third. I think we stick together for Kettinge in a phenomenal type of way with the city's guild and different communities." (Frederik, 2020; 15:15) [Own translation]

This belief about strong local communities is brought up in multiple interviews for why public meetings are preferred, and not only in the town of Kettinge. With strong local communities, people seem to help each other out and want to be a part of a local network. This is explained by Niels, who prefers that some kind of network is established where ideas and experiences can be shared between heat consumers to help change away from one's oil boiler (Niels, 2020). However, towns and communities can also be too small. Ole explains how his town is not big enough and public meetings cannot be used to something as establishing support for a local district heating network:

"I think in this small town, Frejlev, where I live, I do not believe you can establish a forum about collective heat supply in the city. It [Red. district heating] is so pervasive and has never been

close to the city. The neighbor town, where the straw heat plant is, They actually made a heating plant, however, we are not enough in this small town with few people.” (Ole, 200; 15:56) [Own translation]

This shows how it is important to have a good definition of what a public meeting should contribute to. In small towns, it should not be to establish a local district heating network if houses are too far for each other. Instead, a public meeting could be to create a network where citizens can give each other advice on solutions for individual heating. Another element that is mentioned in some of the interviews is who should take the initiative. If either it should be a top-down approach started by the municipality and the district heating company, or it should be a bottom-up process initiated by heat consumers. In two interviews it is mentioned that it should be the municipality or the utility company, REFA, who should take the lead and invite to public meetings.

“Such information meetings, that works very well. But I think taking the role as energy coordinator, that I think becomes too much. It is a big responsibility as well. We would like to be at somebody’s disposal and such but we would not be them with the coordinating role. That could be REFA or someone else who has it as their primary job.” (Hanne, 2020; 18:42) [Own translation]

“ That will be the smartest [that the municipality takes the lead] because I do not think that you can pull yourselves together to do it. [...] It has to be regarding someone organize it, for example, the municipality. Then you can register and show up to an information meeting.” (Rie, 2020; 19:42) [Own translation]

These two heat consumers' thoughts about who should organize and invite to public meetings show how it must be current organizations that take the lead as it can be too much for heat consumers. Besides, it also reveals that in these cases where current organizations as the municipality and utility company invite for public meetings about heat supply, it should be informative meetings. A place where heat consumers can get knowledge about what options they have of heat supplies, what are the plans for expanding district heating, or get questions answered to their situation of heat supply. When it is the current organizations that invite for public meetings, it will also be them who decide the agenda. This is not the case when it is local citizens who invite for public meetings as done in Orehoved. In this case, a local enthusiast tried to get a local heat plant established, a project started by heat consumers instead of the organizations (see Chapter 7.1.5). This time, it was the heat consumers who invited the municipality and who decided the agenda. However, this could also become a problem as described by Rico who was a passionate advocate for the project:

“I have to say in such a project they should not have ordinary civilize as anchorman. It has to be someone who has tried it before. [...] Then you do not fumble for answers and the right arguments etc. It has to be professional.” (Rico, 2020; 31:30) [Own translation]

The citizens who started the whole project did not have the same skill set as a municipality or utility company might have, as these organizations have been managing projects many times before. Because the local enthusiast did not possess the right tools and was not able to come with the right answers under the public meetings, it made other participants nervous if it was the right project to be a part of.

Previous experience with the municipality and utility company can either be a barrier or an advantage depending on either previous negative or positive experiences with these organizations. These previous experiences can come off in future cases as either being motivational or discouraging as explained by these three heat consumers:

“Yes, an enormous skeptic. But that is common for our area. We are governed by REFA and some think REFA is a dictatorship. One man is sitting on the top and tells how things should be [...] and you have seen that many times. [...] It annoys me. It is unpleasant, they are not listening to what the citizens are saying.” (Frederik, 2020; 23:12; 26:09) [Own translation]

“It was really good. Those at the meeting knew what they were talking about and we had that impression that they did not embellish anything. [...] You become positive when things work and what you have agreed upon work and succeed. In other cases, I think I will be well met as well.” (Rie, 2020; 21:53)

“There has been someone who handles the process and you become involved in these plans, municipal plan, etc. Then someone sits and writes everything down. Then I think you are being taken seriously, it has been really good.” (Merethe, 2020; 18:12) [Own translation]

The first quote is about the biggest utility company in Guldborgsund Municipality, REFA. The second quote is about an unknown utility company, while the last is about a previous experience in a public meeting held by Guldborgsund Municipality. These clearly show how citizens can either be well-disposed or not toward these organizations from previous experiences or relationships. If heat consumers are being taken seriously and being heard, this will have a positive effect on the future project. If the opposite is the case, people will be negatively motivated from the start.

It is also a question of when heat consumers in public meetings should be involved. A great consensus between the interviewed heat consumers has been to be included early, but only after a problem has been identified or a project is in the pipeline. Frederik explains:

“Yeah, it has to be almost at the start. First, you have to identify the problem but right after there, then you can start to include citizens in the process. You have to. And you need to know everything about your numbers and all that. But I believe that the municipality knows how to do that.” (Frederik, 2020; 20:15) [Own translation]

People want to be included, and not just informed. That is why they want to be included early where things have not yet been decided. This gives organizers the choice to take any precautionary measures to secure people are not left displeased. This was also the case in Orehoved. After the local enthusiast had calculated what the local heat plant and other expenses will cost, the information was sent in form of pamphlets to rest of the community with an invitation to a public meeting three months later. This gave them time to see the numbers though and prepare any questions.

7.2.2 Information and counsel

Another type of public participation is to get information, provide information, and getting counsel for one's own house's heat supply. This is both seen as an addition to public meetings while for others it will be preferred. Merethe explains why:

"I think sometimes when you participate in many public meetings, sometimes it is protracted. I would like to provide our experiences and what we have done and then come with experiences in an interview." (Merethe, 2020; 16:07) [Own translation]

Instead of seeking information, some would be interested in providing knowledge and information as Merethe, who has a big wood pellet boiler to heat a farm. It can for some people be overwhelming to install a new type of heat supply and if these people could get some experience from one who already has tried it, it might help them take the final decision. Merethe continues:

"A lot of young people would like to move down here. But at that moment they hear about heat demand, that it is something you have to handle yourself, and you actually have to do an effort, then it scares them away. That is why I would like something where you could seek help for counsel." (Merethe, 2020; 17:23) [Own translation]

Just as it can be important to provide information for other people in similar situations, it is even more important to know where to get information and counsel to secure newcomers who are not left alone. This can be information about the cost of installing a new heat supply, which types of heat supply is available, and if district heating is scheduled to be expanded. This information is not very easy to access and can be a barrier that delays a greener transition in individual heat supply. As well, it can also be an issue that all houses and each heat consumer are not the same and have different priorities. Each house is unique and specific counsel could help some heat consumers choose the correct solution. This is the case for Ole, who has bought a house and is renting it to the daughter and son in law. They do not know if they should change the oil boiler with an air-to-air heat pump as this is what heat supply Ole has in his own house:

"I would like some pamphlets that showed me some good examples of reading and prices, maybe. What I know from own experience is to contact a plumber or technical installer, then I have some certainty if there should be placed 15,000 kr. for a heat pump. The problem with this small house is that we are talking about decor with partitions, that one heat pump will have difficulties with distributing heat around the house, I think. And I would like to know if it could have a chance to distribute the heat in all four corners." (Ole, 2020; 18:13) [Own translation]

This is an example on how a heat consumer needs help to choose a new source of heat supply, and if the heat consumer is not getting any counsel, they will just install an air-to-air heat pump which must be assumed not be the most effective solution, and a solution which is only viable if a house does not have a water-driven heat system.

7.3 Sub-conclusion

This chapter has been answering the third sub-question of *"how do heat consumers want to be included in the transition to other forms of heat supply?"*. This has been done by analyzing eight heat consumers' thoughts from seven interviews on what behalves they are choosing heat supply from and how they want to be included in public participation.

The findings from this analysis can be found in Table 8 below and show how many different factors are playing into how and why heat consumers are changing heat supply and how they want to be included in a form of public participation. It must be mentioned too, that this is a collection of reasons and all are not implying on each heat consumer in Guldborgsund Municipality.

Reasons for keeping or changing heat supply	
Economy	<ul style="list-style-type: none"> - Choosing the cheapest option - Can be seen as an investment if staying in the house - Investments in necessary upgrades of heat system can be necessary and make changing heat supply more expensive - Not possible to get a loan from a bank for new heat supply - Waiting for subsidies from the state
Environment	<ul style="list-style-type: none"> - Some want to get a more sustainable heat supply - Others are not interested in the environmental impact a heat supply can have - Can be a catalyst to change heat supply - Economy weights higher than the environment
Convenience	<ul style="list-style-type: none"> - It has to be easy to maintain - It has to be easy to implementable in the house's current heat system without any further implementations - Needs the right facilities of space and heat system
Uncertainties of the future	<ul style="list-style-type: none"> - Changes in oil prices - Fear if new legislations can enforce changing heat supply - Uncertain if district heating is a future possibility - Rather change before it breaks
Uninterested	<ul style="list-style-type: none"> - Can be satisfied with what they have today - Are not interested in any change
Types of way to be included	
Public meetings and networks	<ul style="list-style-type: none"> - A strong local community induces people to gather and help each other - Top-down invited process can be used to provide information and answer questions from heat consumers - Bottom-up invited process can be used to create new projects and involve the community - Former relations to the municipal and utility company has either a positive or negative influence in heat consumers attitude towards a project - Heat consumers must be included early in the process but only after there is some concrete information
Information	<ul style="list-style-type: none"> - Heat consumers want to provide information for others to benefit from - Pamphlets or hotlines from where heat consumers can get information about different options of heat supply
Counsel	<ul style="list-style-type: none"> - Getting counseling and advice on what type of heat supply to choose and what it will cost

Table 8: A collection of conclusions found for each subject in Chapter 7.

8. Discussion – Introducing public participation in energy planning

This chapter will discuss and answer the fourth and final sub-question of *“in what way can public participation help oil boiler owners change their heat supply?”*. This will be done based on findings from the three previous analyses where the roles of the different stakeholders have been scrutinized and heat consumers’ points of view have been analyzed. This discussion will address if the role of the energy planner in municipalities should change and how they best involve heat consumers in the current energy planning. Additionally, it will be discussed how this research's findings can be used in other cases and how this subject can benefit from further research.

8.1 Evolving the role of the energy planner

It has been a paradox in this research that it has been investigated how heat consumers can be included in energy planning, and the case chosen has been phasing out oil boilers where oil boiler owners have the power to decide if they want to change heat supply while the municipality has no real saying. This might be the same perception Guldborgsund Municipality have and why they have chosen to remain passive in the process of letting oil boiler owners change their heat supply. It has also been the case that the municipality does not believe that heat consumers have any particular interest in any form of energy planning. These are the reasons why Guldborgsund Municipality has not included heat consumers in their work. This applies both for creating the plan for heat supply, but also in the process of phasing out oil boilers. Interestingly, it is not true when Guldborgsund Municipality says that heat consumers are not interested in being included in energy. Through interviews with heat consumers, it became very clear how they wanted to be included in everything from getting information about plans for district heating to participate in public meetings and networks. This shows how the level of stakeholders’ interest in tables 4 and 5 (see Chapters 5.3 and 6.2) mainly are based on subjective standpoints from the energy planners where the level of power is more objective matters as it is grounded by laws and regulations. The question then emerges, why does today’s energy planner in the municipality think that heat consumers do not want to be included?

Today, the energy planner’s role is to work inside a bureaucratic environment of politicians and political agendas but is still obligated to maintain an expert role (see Chapter 5.2.1). This type of energy planner does not have any tradition of including citizens, and the only opinions from other stakeholders they take into consideration are from utility companies and external consultants. This way of work in energy planning has become ingrained to a political extent as well, as the city council

in Guldborgsund Municipality agrees on the choice to remain passive in the transition away from oil boilers and do not provide any resources to include heat consumers in energy planning. The act for heat supply might also keep the energy planner locked in the role of only functioning as an expert planner. This act implies the municipality to make a plan for heat supply where it has to promote the most socio-economic solutions and secure energy plants are running as effectively as possible (Klima-, Energi- og Forsyningsministeriet, 2020). This entails that the energy planner must be very technical in its work and public participation does not have any relevance in this type of plan. Then maybe it is not the energy planner's fault that they think heat consumers should not or want to be included in energy planning. Energy planners are given a scope to work within, a scope where they only can function as a technical expert. Simultaneous with those cases where they are contributing to help heat consumers establishing local district heating networks (See Chapters 6.1.1 & 7.1.5), they see a low level of support which only strengthens the story of heat consumers are not interested in energy planning, something this research has shown not to be true.

8.1.1 Including more stakeholders in energy planning

There is a need to change the role of the energy planner and find a way for this change to happen if public participation should be utilized in energy planning. There are many options to what role an energy planner could take on with inspiration from urban planning (see Chapter 4.2). In scenarios where the energy planner would have to include multiple stakeholders in the planning process and negotiate between different opinions, it could be an idea to function as a pragmatic planner. This could be a new element when making the plan for heat supply. More stakeholders could be introduced as heat consumers, plumbers, and people in the oil boiler business. However, pragmatic planning is just as much about finding compromises and common consensus between all stakeholders to secure everybody is satisfied. This is something that can be difficult with different requests and motivations from multiple stakeholders. Some interest groups want to keep their business, some want a more sustainable heat supply, while others want solutions to be as cheap as possible. This it will only be possible to agree on small initiatives and when pragmatic planning is known as working ad-hoc, it is not optimal for long-term planning as a plan for heat supply.

Another option for the energy planner is to practice advocacy planning, where the planner should fight for the little guy (see Chapter 4.2). In this case, the little guy will be the heat consumers, but who are they fighting against? Themselves as owners of the district heating companies? This does not make sense and is not a recommended approach to energy planning. Instead, a more collaborative approach might be the right direction for the energy planner. Instead of only using their expertise and

experience about how to plan for energy in a municipality, the energy planner will get contributions from all relevant stakeholders. However, it should not be pragmatic planning where everybody must agree on the outcome. Instead, it will become a consultation from other stakeholders and the energy planner must be good at sorting requests that are relevant and what is not possible. The energy planner must learn from other stakeholder's realities and not just go back to what they are used to after the meetings. This form of inclusion can be done to find the next district heating project or in expanding the plan for heat supply to also include a strategy of how oil boilers can be phased out. It can also be beneficial to those projects where heat consumers in a community want to establish a local district heating plant. Instead of functioning as the technical experts and only provide knowledge about technologies and economic scenarios, the energy planner must be more of a facilitator. As seen in the case with Orehoved, some heat consumers tried to establish a local district heating network (See Chapter 7.1.5). Here somebody's mistrust reflected on other heat consumers and could have been avoided if the energy planner was given the responsibility to run these public meetings. The new responsibility given to the energy planner would then have been to steer this meeting and accommodate negative voiced heat consumers.

8.1.2 The hybrid energy planner

With the need for these extended roles for the energy planner, the old expert role seems to have become outdated. However, this does not mean that the energy planner should forget everything about being a technical expert. It might be most beneficial if the energy planner becomes some sort of hybrid energy planner instead, who can adjust the role according to the case. In the work of making the plan for heat supply, the energy planner will still mostly have to function as an expert planner when mapping areas to potentially expand the district heating network and calculating if projects are financial and socio-economic possible to initiate. However, including heat consumers into this process to see if some communities are more interested in collective heat supply than others, a more collaborative planning approach must be used to benefit from this and to easier prioritize certain projects over others. Just as well in the planning of phasing out oil boilers, having a more communicative-centric approach could help find out why oil boiler owners are waiting to change heat supply, and how the municipality could help this process move forward. Helping local enthusiasts establishing a local district heating network calls for a combination of roles. Here the planner can both function as the technical expert but also be the facilitator. In cases where a community wants to consult and help each other, the hybrid energy planner must be the moderator to make sure

everybody gets the word. It is not about changing the role of the energy planner more than the energy planner has to evolve.

Even though there is evidence for the energy planner's role to evolve, this is not just something that can happen one day to another. There has to be something starting this transition, but how is that even possible when the role of the energy planner today seems to be locked? The change will not happen unless something kickstarts it. One option could be that the city council wants to see heat consumers being included in energy planning. The problem with this is that they have the same perception of energy planning and has chosen to remain passive when it comes to phasing out oil boilers. The change has to start from somewhere else. This could be in the legislation of heat supply and in the instructions of how a plan for heat supply should be made. If legislation demands a plan not only included planning for collective heat supply but also individual heating, it will create an enticement to communicate with heat consumers with individual heat supply. Just as well could the law of heat supply be changed, so district heating projects will not mainly be proposed because it is financially sustainable but also if there is a big enough demand from a community. However, this can create a catch 22, as if the price of district heating becomes too expensive, not as many heat consumers will connect to the network because the economic factor is so important (see Chapter 7.1.1). If it is possible to somehow change the legislation to dictate that energy planners must incorporate public participation in the decision making of establishing district heating networks or creating the plan for heat supply, this will create a need for the energy planner to change between roles as an expert, facilitator, mediator, and collaborative (Figure 8).

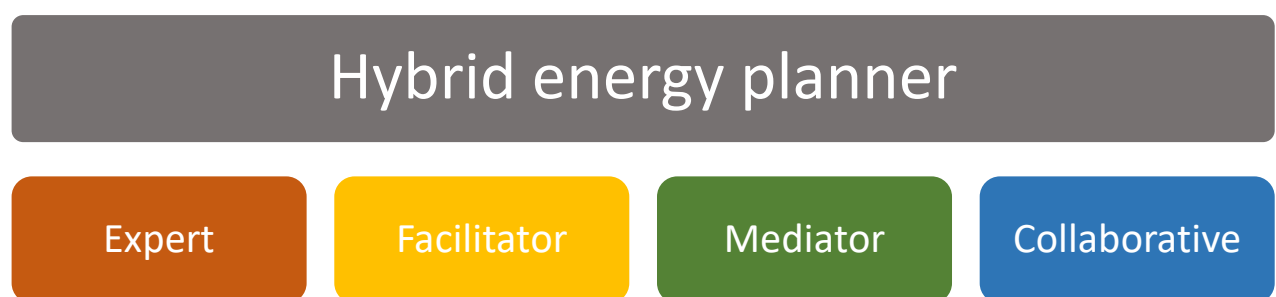


Figure 8: The different roles a hybrid energy planner must possess in energy planning (Own Illustration).

it can be a problem that today energy planners might not possess the competences to take on these new roles. If they have only been taught inside that paradigm of the energy planner being the technical expert, they do not have the tools to just change their role and they will not know what it will say to include heat consumers in energy planning. Here the current energy planner could look into which

type of consultant they are hiring for a job. Like in the case with Rambøll helping Guldborgsund Municipality to conduct the plan for heat supply, Guldborgsund Municipality could instead of hiring an expert in energy planning, find another type of energy planner with competences in including heat consumers. If the energy planner in the municipality is open for this, they could even learn something from the consultant's work. Just as well it must be expected that with more focus on public participation in education inside the field of planning, it can be an ongoing transition over a longer period. However, it must be made sure that new energy planners are not continuing in the same role as previous energy planners. This can be avoided if the old tradition of energy planning changes in both legislation and the municipal organization – the first step to a radical technical change.

8.2 Incorporating heat consumers in energy planning

Since the energy planner must evolve from being an expert planner to become a hybrid energy planner with options to use different roles in different scenarios, the question then emerges if it is even a good idea to include heat consumers in energy planning? Through the analyses, both benefits and challenges have been seen when including heat consumers in this energy planning. These findings both come from planners' and heat consumers' points of view, but can the benefits outweigh the challenges?

8.2.1 Establishing local networks

One of the biggest issues seen from the municipality's point of view to include heat consumers in energy planning and phasing out oil boilers is the power balance between the oil boiler owners and the municipality. This was both mentioned by Hjørring Municipality and Guldborgsund Municipality. However, it was never a discussed topic in the interviews with heat consumers. Oil boiler owners have the power to decide if they want to change out their oil boilers or not, and this level of power has made the municipality not see a purpose to include these people in some form of planning for a transition of heat supply. This could be because of the traditional way to understand public participation, where normally it is the municipality who has the power of a project where they can choose to include citizens. In this case, it will be the heat consumers' case where the municipality will have to include themselves to help the same heat consumers phase out their oil boiler. This can be a confusing relationship for the municipality as to why they cannot see the purpose since oil boiler owners have the final decision anyway. Surprisingly, heat consumers want to be included in some form of public participation. For some heat consumers, they have a hard time pulling themselves together to make the change away from their oil boiler (see Chapter 7.1.3). For others, they need specific knowledge of how they can change heat supply, what options they can choose between, and

who to contact to get specific recommendations (see Chapter 7.2.2). Since heat consumers do not have this knowledge, it stops or slows down the radical technology change of heat supply. This is where the municipality can take the first step and start local networks between heat consumers. With a top-down approach where the hybrid energy planner invites to public meetings in local communities, heat consumers can give each other counseling by telling about experiences and different alternatives there are to oil boilers and other forms of heat supply. This will be possible as these small towns have strong communities where people want to help each other (see Chapter 7.1). By including heat consumers in this form of energy planning, they help accelerate the time it takes oil boiler owners to change out their heat supply. This type of network also starts the radical technology change, as heat consumers get new knowledge about the different heat supply-products, how the operation of heat supply will change with new solutions, and if they can profit from it in the long run. When the hybrid energy planner invites to these networks in different communities, the role of the hybrid energy planner will be to function as a mediator (Figure 9). The energy planner will not be the one in focus, it will be the heat consumers, and therefore, it has to be made sure that all heat consumers who either have a question or experience can get the platform to talk. Just as well can plumbers be invited to tell about how a change from their current heat supply can be done and what kinds of other investments they have to consider when changing heat supply. Therefore, the municipality has to look beyond the power balance and instead focus on how to help individual heat consumers.

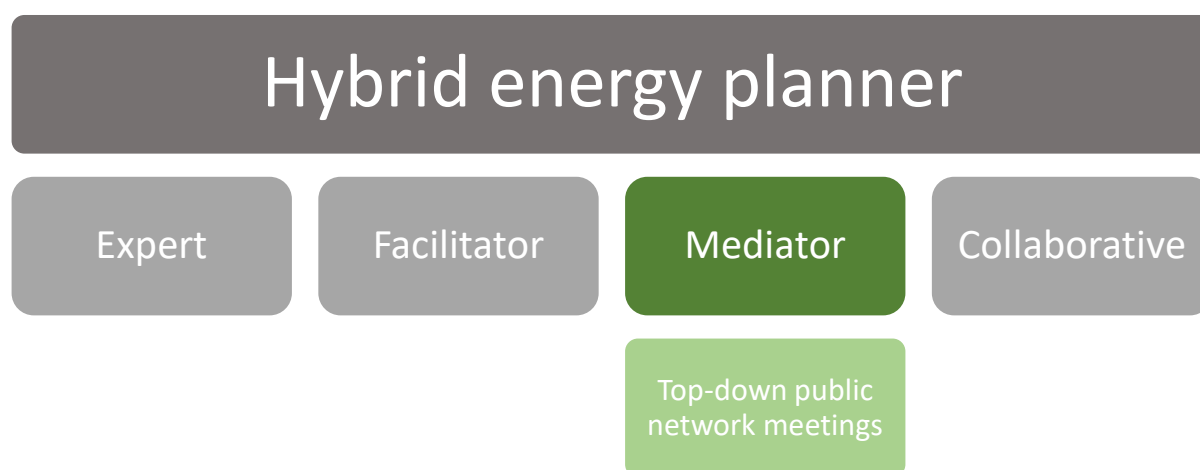


Figure 9: What role the hybrid energy planner should use in top-down public network meetings (Own Illustration).

8.2.2 Public participation used in the plan for heat supply

Another challenge to include heat consumers in energy planning is when it does not have any relevance for the heat consumer (see Chapter 5.2.2). This is today the case when Guldborgsund Municipality creates the plan for heat supply. A plan which will focus on which technologies utility

companies should use to produce heat on behalf of how district heating will evolve in the municipality. When making the plan the power balance is more traditional and the municipality has the decisive power in cooperation with utility companies. When heat consumers neither are seen as being relevant to include in this plan nor them having any interest, they are of course not included. As the plan for heat supply is supposed to be today, it is also understandable that it will be too technical for heat consumers and they do not have anything to bring to the table. This is why the hybrid energy planner still has to function as an expert (Figure 10). However, if a plan for heat supply also includes how district heating in the municipality should expand, heat consumers will have a great interest in the results. It is seen through the analysis that some heat consumers are interested in getting supplied by district heating and are waiting to change heat supply in the hope of the district heating network will come to their house (see Chapter 7.1.4). When the plan for heat supply is published, the municipality and utility companies should make an informative meeting where future projects are being presented. However, heat consumers want to be included early in public participation before decisions already have been taken (see Chapter 7.2.1). Making ongoing workshops to find areas with the support of getting district heating could help this issue. The process of using workshops and informing meeting will give heat consumers insight into if they should change heat supply now, or if they could get supplied with district heating in the future. It can also help to get more heat consumers to connect to the future district heating network, as future district heat customers would not have been invested in another type of heat supply beforehand which has to be paid before they can change again. Heat consumers will just as well not change heat supply unless they have the money. Instead, they will individually choose what for them is the cheapest option. Therefore, there is a need to get as many heat consumers prepared for district heating in future district heating-zones so enough will choose this option and make it as cheap as possible. Today, the plan for heat supply is public on the Guldborgsund Municipality's webpage, but since some heat consumers are still unaware of the plan, this plan and information about future projects must be communicated more clearly out to the public.

In the case of including heat consumers in the plan for heat supply, the hybrid energy planner must use a collaborative approach where different stakeholders are included and where they in cooperation find potential towns to expand the district heating network (Figure 10). This will be more relevant to the heat consumers as they can argue for why district heating should come to their town, instead of discussing technologies used in district heat production. However, it might not be every heat consumer who wants to participate or have the time. Should it therefore only be those heat consumers with interest and resources enough to participate through public meetings and workshops who should have the change to get district heating to exactly their town? Instead, the municipality

could take another approach. They could also send out surveys to get an overview of which areas do heat consumers want district heating and when they plan to change heat supply. This could point out some towns over others where it will make more sense to establish or expand district heating networks. If a plan for heat supply also should include a strategy for phasing out individual oil boilers, a survey could also help map the problem and in which areas people are thinking about changing heat supply but do not know to which other option. Here, additional interviews can go into depth and help find out what is needed to make heat consumers change, just like done in this research.

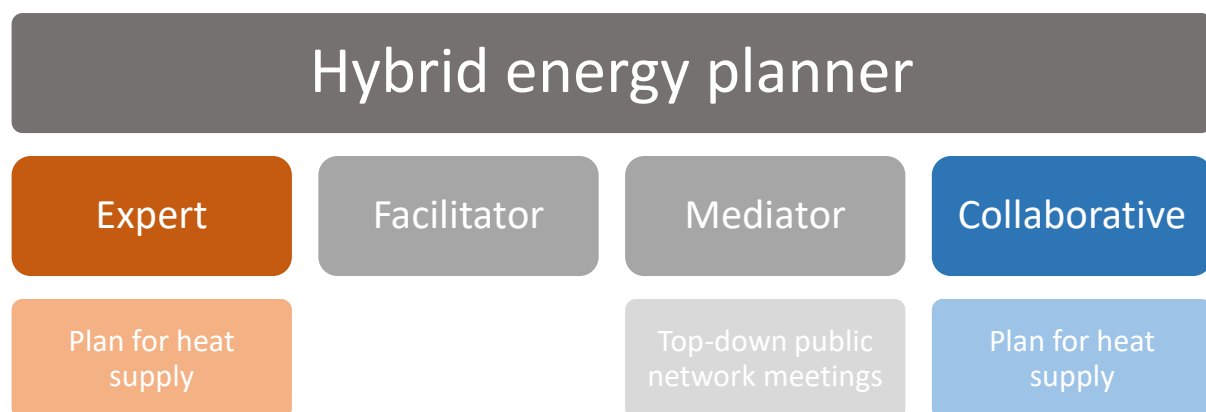


Figure 10: What roles the hybrid energy planner should use when making the plan for heat supply (Own Illustration).

8.2.3 Public meetings in community-driven projects

Greater community-driven projects, like establishing a local district heating network, can become very prolonged (see Chapter 6.1.1). When heat consumers control a project that takes multiple years and ends up not being carried out, neither heat consumers or energy planners want to repeat the same process. In public meetings, conflicts have also been shown to emerge. Some can criticize a project so much, other starting questioning if it is a good idea, maybe because it is too radical of a technology change of what they are used to. This is where the new role of the hybrid energy planner must show its worth too and help doubtful heat consumers overcome the fear of change. With public participation in planning, conflicts will inevitably happen (see Chapter 4.3). Different people have different agendas, and disagreements result in turf wars. With this knowledge, the hybrid energy planner can help by facilitating these bottom-up public meetings and collaborate with and between the different heat consumers (Figure 11). Conflict can also be prevented if the hybrid energy planner is ready with good arguments to the critics and focuses on all the benefits given by the project as was needed in the case of Orehoved. These arguments could be the ones found in this research about what can make heat consumers change heat supply (see Chapter 7.) like it will be better for the environment, it can be a cheap option if there is support from the whole community, and that it is a

convenient type of heat supply where they do not have to clean any boilers or fill anything up with fuel. These options are also a method to prepare heat consumers for a radical technology change when teaching about new products, how they operate and providing knowledge of how it is possible to change out their old form of heat supply. The hybrid energy planner can also benefit by using its role as a technical expert as before by helping with calculations and knowledge from other similar successful cases (Figure 11).

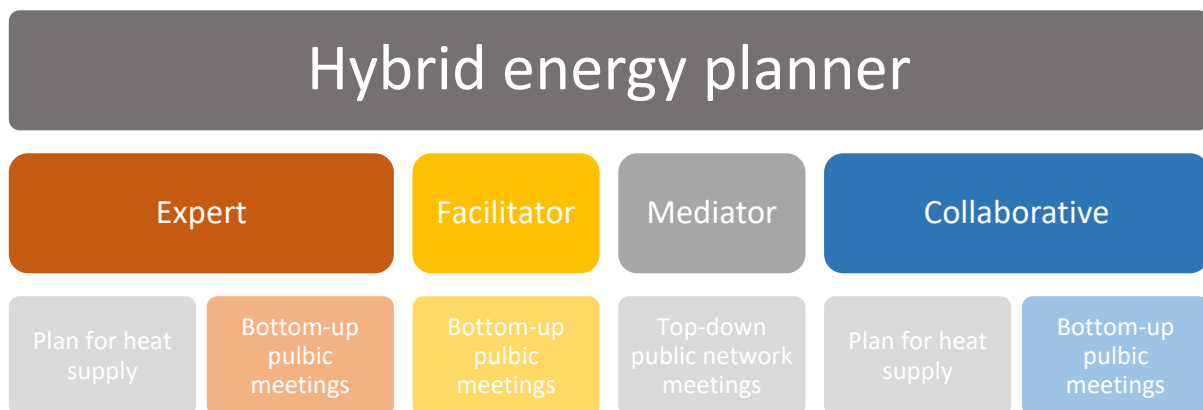


Figure 11: What roles the hybrid energy planner should use in bottom-up public meetings (Own Illustration).

To function as a facilitator to help heat consumers carry out their project and by being a collaborative planner to make stakeholders cooperate and find a common solution, the hybrid energy planner must be handed this responsibility from the local enthusiast who started the project. But are local enthusiasts willing to hand out their power? It can be feared that local enthusiasts see the project as a matter very close to their heart, and it should only be them who decide how the project should go, even though they might not be competent enough to run such public meetings. Then the local enthusiasts would rather make the project run out in the sand than give away their power. However, if this will be the case, it is still the heat consumers who would have the power to decide if there is enough support for the project. The hybrid energy planner is just there to make the process run more smoothly and help it succeed. It can also be an issue when the municipality goes into a local-driven project that heat consumers have prior experience with the municipality.

Having bad experiences with the municipality from other projects, heat consumers can be doubtful from the start, even though it is a different energy planner or a different sector. However, in Guldborgsund Municipality there is no issue with heat consumers having bad experiences with the planners unless it is REFA, the utility company, who is invited as some are very displeased with how they are handling their business (see Chapter 7.2.1). To keep the good relationship between heat

consumers, the municipality, and potentially the utility company, the heat consumers must be taken seriously in public meetings. It should not be a séance where heat consumers are being included just to be included. Instead, it should be possible for heat consumers to ask concrete questions and to give relevant information that the planner can take with them in the further process. It is just as important to include heat consumers early and give them something specific to relate to before the public meeting, for example, the economic premises or a time-schedule for a project. This gives heat consumers time to reflect, prepare questions, and can easier provide help which will be a greater contribution than only letting them be informed at the meeting. By waiting to inform heat consumers, this will also be contrary to heat consumers' wish about being taken seriously, as a late involvement shows that they are not needed. If these points are taken into consideration by the hybrid energy planner, bottom-up projects can strengthen, and quality assures project which can give oil boiler owners incitement to change heat supply.

8.2.4 Supporting heat consumers to choose a new type of heat supply

Lastly, there is an unexamined group of people who do not care about their types of heat supply or do not want to participate in any form of energy planning (see Chapter 7.1.5). Different reasons might be to this as this group of people are pleased about their current oil boiler or do not have the time or energy to participate. No matter what, there should still be a way for them to seek help when the day comes where they need to change heat supply. From these heat consumers' points of view, it will not be through any form of public participation. Instead, there must be a place where they can seek information about the different options of heat supply, what the price ranges are for the different technologies, and who to contact to get specific counseling and an offer. One way to make this possible is by the hybrid energy planner functioning as an expert and being able to answer technical questions (Figure 12). From this, heat consumers can contact the hybrid energy planner who then can tell over the phone or in emails what types of heat supply that sound most realistic and who the heat consumer can contact if they want more advice, instead of just referring to the SparEnergi.dk-website without the heat consumer knowing where to start. If this type of hotline is believed to cost too much time and resources, pamphlets could be made as well to spread the information. As some heat consumers are willing to tell their stories about how they changed heat supply, these narratives can be collected through interviews or through public network meetings to benefit other heat consumers in similar situations. By including heat consumers in this form of energy planning, where heat consumers can consult each other, it will help oil boiler owners change to different types of heat supply instead of only changing to a new and more effective oil boiler. The risk could be that changing

to another oil boiler, the chimney might have to be renovated as well, and a solution that first was seen as the cheapest might not be the case in the end when all expenses are taken into consideration. Heat pumps bought on subscription can also be advocated if the heat consumer cannot afford to buy one privately.

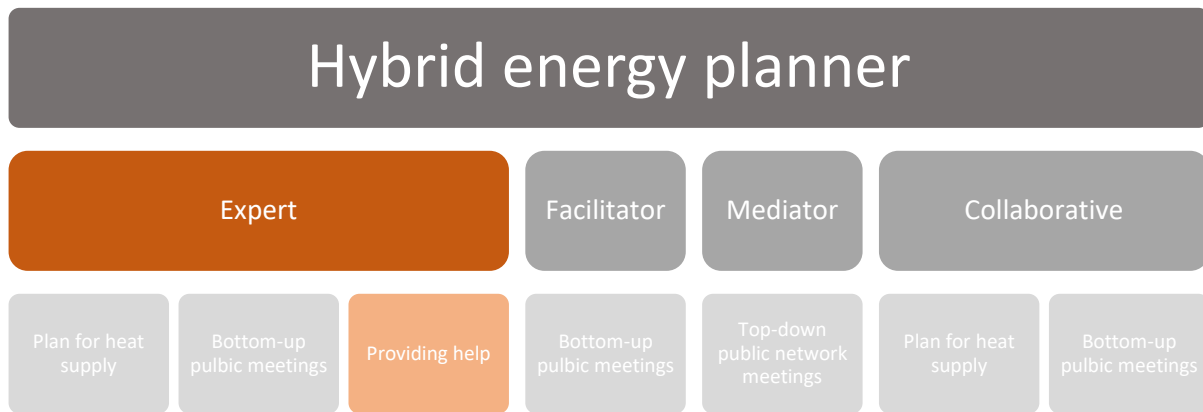


Figure 12: What role the hybrid energy planner should use when providing help to heat consumers (Own Illustration).

8.3 Discussion of results and further research

The main goal of this research has been to investigate if public participation can benefit energy planning. This has shown to be the case to help phase out individual oil boilers, but only if the energy planner evolves from being an expert planner into a hybrid energy planner who can represent multiple roles in different scenarios, something that can be seen to be very complex (Figure 13).

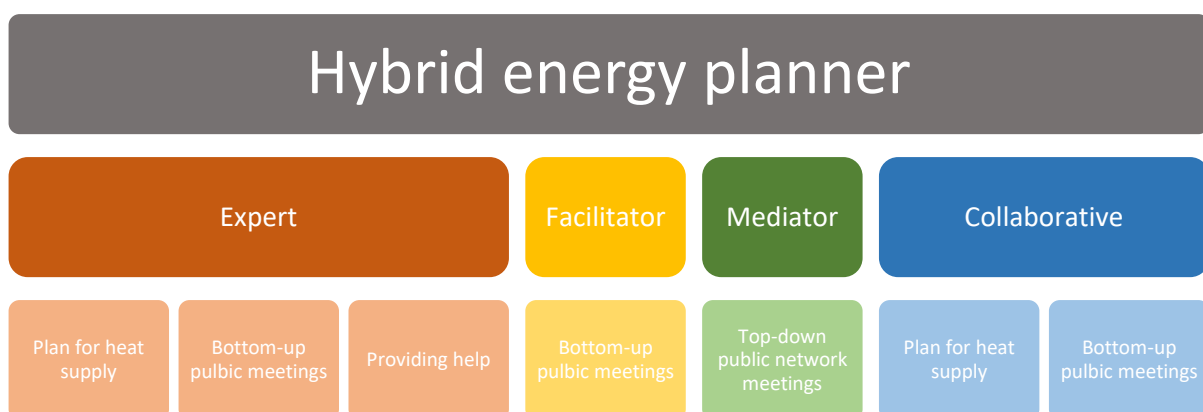


Figure 13: All the different types of roles and when the hybrid energy planner should use them (Own Illustration).

This change of energy planning has now been investigated on a theoretical stage, and there is a need for testing this new type of energy planner in practice. Compared to the case of Hjørring Municipality where they invited oil boiler owners to talk to each other about their experiences, somethings which

also is suggested in this research, it never succeeded (see Chapter 1.2). Heat consumers were there to listen to what the municipality had to say, which indicates a deficient explaining of the purpose of the public meetings and an energy planner who did not possess the necessary ability to function as a moderator.

8.3.1 Using a mixed-method approach

A limitation of this study has been those heat consumers who have not been included in the research. In all of the seven interviews, heat consumers were positive about wanting to be included in the energy planning, but is this representative for all heat consumers? With a combined number of more than 1,000 members in the Facebook groups which were reached out to, there is a big group of people who did not show any interest in participating in interviews. This could be caused by that only current and previous oil boiler owners were requested in the Facebook-post, but it could also indicate that a big group of people did not want to use their time on being interviewed, or maybe they have no interest in talking about their heat supply. A way to include this non-participatory group of people more easily could have been by sending out a survey in the same Facebook groups. This will not require as much time and energy from heat consumers as it would be to be interviewed, and it could give a more representative picture of heat consumers. Therefore, a quantitative method will have could show any patterns if there are a certain type of public participation heat consumers prefer over others, and which factors are most and least important when they should change heat supply. This knowledge could have been used in the interviews to clarify and get a deeper understanding of why these factors have been preferred. Using this mixed-method approach, there is a better chance to also get an understanding of heat consumers who do not want to participate. One thing it could clarify would be if local communities are really that strong as mentioned in the interviews (see Chapter 7.2), or if it is only strong for some people in the community. If communities are as strong as they say, why is it not strong enough to establish the local district heating projects? Maybe it is only seen as strong for those who also have the energy and resources to participate in projects, while it is seen as the opposite for other people because they do not want to include themselves in any joint activities.

8.3.2 Applying findings to other cases of energy planning

This research has used individual oil boiler as a case, but is it possible to use the same findings in other cases as well? There can be cases where municipalities and utility companies want to make heat consumers change away from gas boilers, as natural gas is a fossil fuel like oil as well. In this case, an evolution of the energy planner is still needed if public participation should be utilized. Public

participation can also still be used to create networks where heat consumers can tell their experiences about how they changed from natural gas into district heating or a heat pump. However, there is a difference between changing from natural gas instead of changing away from an oil boiler. Natural gas is like district heating planned in cooperation between the municipality and utility companies and is an incorporated part of the plan for heat supply. It is also the role of the municipality and utility companies to map the zone for this type of collective heat supply, which gives these organizations a different role compared to phasing out oil boilers. Heat consumers will still have the most power as they can choose when to change heat supply. However, if a natural gas boiler owner's house gets classified to be in a district heating zone instead, they cannot install a new natural gas boiler when it has to be changed. The municipality's change of role might demand more research to be made as it is a part of their job to plan for both types of collective heating. Just as well can there be other factors for heat consumers to either change or keep their natural gas boiler. Still, it is assumed that many of the same factors from this research are applicable, as it was not only oil boiler owners who were interviewed in this study but heat consumers with different types of heat supply.

The findings have been found based on using Guldborg Municipality as a case study too, and it can be discussed if the same findings apply to other municipalities as well. Since including heat consumers in energy planning is not mentioned in any legislation and neither in other studies, it must be presumed that heat consumers are most likely not being included in other municipalities' energy planning. Even though this is true, there might be big differences in municipalities as some have a greater share of heat consumers with many resources to be a part of public participation, a denser population, or a much smaller share of individual oil boilers or other types of individual heat supply. Still, this does not mean that the energy planner should not include heat consumers in their energy planning. There is still a need for the energy planner to evolve its role. The difference in municipalities' structure and premises might come down to how easy it is to change the role of the energy planner or how interested heat consumers are to be included in public participation. According to Bent Flyvbjerg (see Chapter 3.2), a case study's findings can be generalized to other cases. However, it might rather be a question of to what degree these results can be generalized. It can even be argued, that these findings and solutions are easier to implement in other municipalities, as Guldborgsund Municipality and its inhabitants do not have as many resources compared to other municipalities (Pedersen, 2020), a bigger share of oil boilers (see Chapter 1.4), and their house prices are too low for heat consumers to loan money from the bank. Interestingly, even though this is the case for Guldborgsund Municipality,

public participation is still believed to benefit energy planning, and it will most likely be the same want from other municipalities' heat consumers.

8.3.3 Why the change must happen now!

One of the most essential factors for heat consumers to either change or keep their current heat supply is the economy (see Chapter 7.1.1). The price is alpha and omega and many oil boiler owners are waiting to change heat supply in the hopes of financial subsidies from the government. Two weeks before handing this research in, the Danish government presented its take on how to reach a reduction of 70 % CO₂-emission. Here they want to grand 2.3 billion kr. in the transition from fossil-fueled options of heat supply to instead district heating or heat pumps. According to the Danish government, this money should be used to reduce taxes on electric hearting from 15.5 øre to 0.8 øre, increase taxes on fossil-fueled heat production, and subsidies of 15.000 to 25.000 kr. for heat consumers to replace their oil or gas boiler with a heat pump. Just as well are utility companies given better conditions to convert areas from natural gas into district heating zones. (Folketinget, 2020) Even though these initiatives are not enacted yet by the Danish Parliament, this calls for municipalities to start changing the energy planner's role now and to increase the use of public participation in energy planning. By helping the heat consumers make the change and making them aware of these financial opportunities, this will help phase oil boiler out of the energy system much more quickly and efficiently. Especially when financial initiatives have been used before and many heat consumers still have individual oil boilers.

9. Conclusion

Energy planners in municipalities can benefit from including heat consumers in energy planning to accelerate the process of phasing out individual oil boilers. This type of energy planning has been held back by the power relation between the municipality and heat consumers, as the municipality cannot force heat consumers to change heat supply. Instead, the municipality should utilize the willingness from heat consumers to participate in energy planning by helping them establish networks where they can educate and consult each other on different types of heat supply. The energy planner can also help facilitate public meetings where local enthusiasts try to establish a local district heating network to secure the right solutions are found and prevent negativity from single heat consumers. Lastly, heat consumers should be included in the process of the plan for heat supply, to help point out new areas for district heating, and to inform heat consumers much more about the plans so heat consumers do not end up unnecessarily postpone to invest in a new type of individual heating or invest in a new solution of individual heating if district heating is planned to be expanded.

To secure heat consumers are incorporated in a municipality's energy planning, the role of the energy planner must evolve to become a hybrid energy planner. This entails that the hybrid energy planner must be functioning as its old role as an expert, but also new roles as facilitator, mediator, and being collaborative in the different scenarios where it is needed (Figure 13 in Chapter 8.3).

These key findings can also be used when phasing out individual gas boilers, and it does not matter which municipality it is and how many individual fossil-fueled boilers there are installed. However, this research's results can still benefit from a study where a mixed-method approach is utilized to also investigate heat consumers who are not as willing to participate. This is particularly important as the Danish government has proposed its plan to finance a transition away from natural gas and oil before 2030. However, financing the transition will not be enough. To secure the hybrid energy planner starts using this study's findings, this research also requests a change in the law of heat supply. It should be stated that individual heating must be incorporated into a municipality's plan for heat supply and heat consumers to be included in the planning process.

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